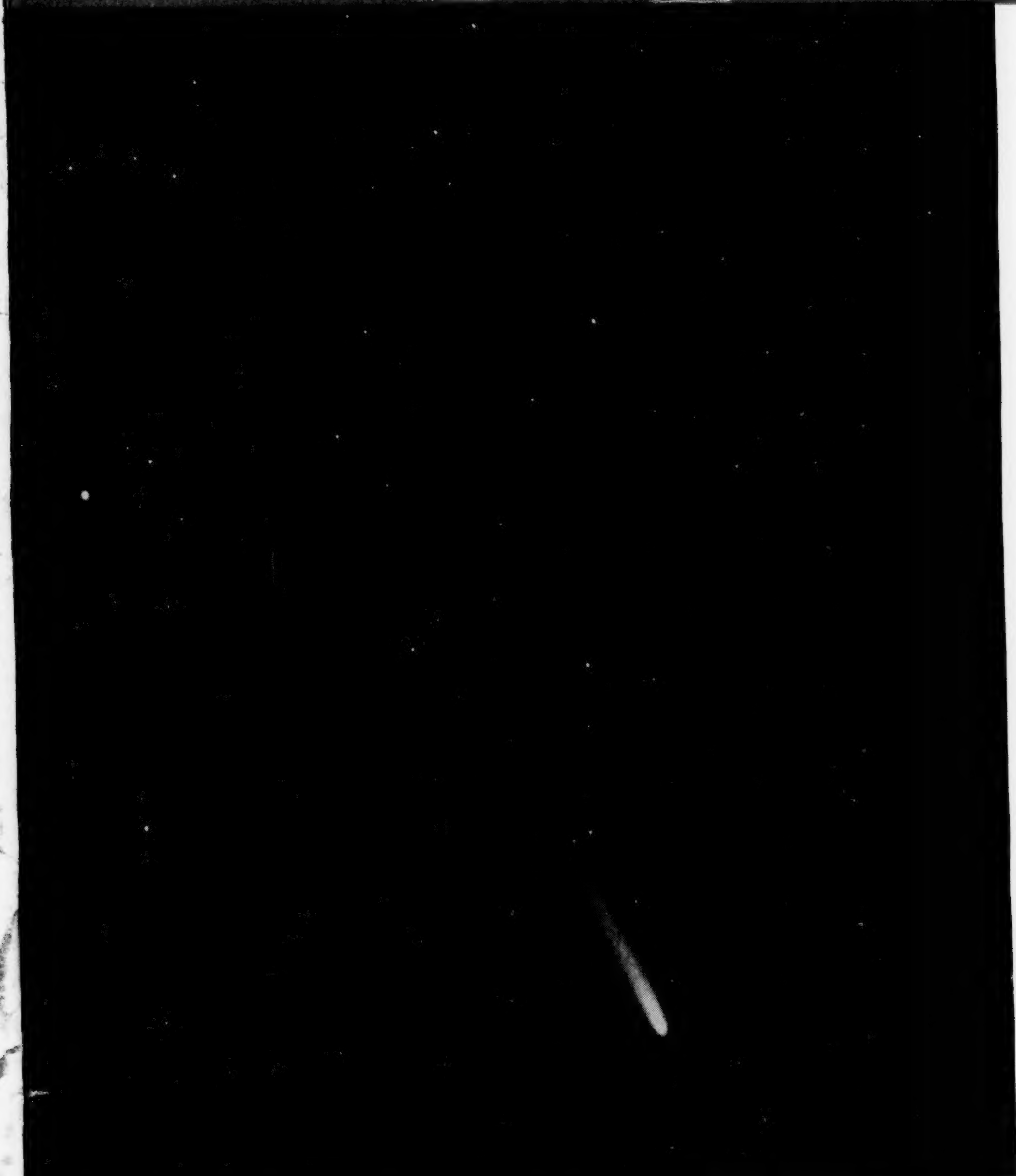
the review of POPULAR ASTRONOMY

FORMERLY . . . THE MONTHLY EVENING SKY MAP

IN THIS ISSUE:

VOL. LV NO. 513

FIFTY CENTS



COMET WILSON — LONG TAIL, SHORT LIFE

SEPTEMBER • OCTOBER 1961

FORMERLY THE
MONTHLY EVENING SKY MAP

the review of POPULAR ASTRONOMY

SEPTEMBER-OCTOBER 1961
VOL. LV WHOLE NUMBER 513

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COVER PHOTOGRAPH

Comet Wilson 1961d, as photographed on July 25th from 8,800-ft. Mt. Piños near Los Angeles by Alan McClure. Comet was discovered on July 23rd but faded in brightness rapidly. Its tail was about 20° in length, and a fan-shaped sunward tail was evident. For further data, see page 12.

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THE AMATEUR'S FORUM

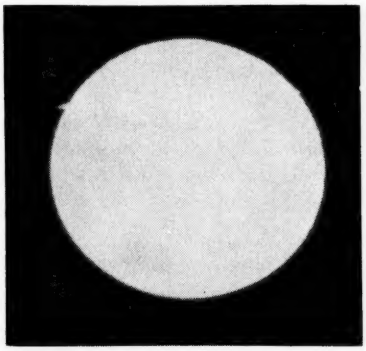
The Review of Popular Astronomy
Dear Sirs:

The San Mateo Astronomical Society will present a program featuring the new astronomy film, "Universe," an award winner at the Cannes, Stratford and Canada film festival. Also, a lecture will be given by O. Richard Norton of the California Academy of Sciences. The event will take place at 8:00 p.m. on Oct. 14, 1961. Anyone interested may contact Richard Johnston, 806 Fiesta Drive, San Mateo, Calif. Phone: FI 5-7783. The event is open to the public.

Richard Johnston
806 Fiesta Dr.
San Mateo, Calif.

Dear Sirs:

I was very interested in reading the letter to the editor by E. Turco. It is my belief that what he describes as a flare is the sort of phenomenon described and photographed by me many times. The enclosed reprint from *The Observatory* will be of in-



terest. I am also enclosing another more recent print. See also my article in the Jan. '61 issue of *Scientific American*. These "mistaken flares" are bound to become more common with increasing number of planes, especially jets, crossing the disk of the sun.

W. A. Feibelman
1063 Findley Dr.
Pittsburgh 21, Pa.

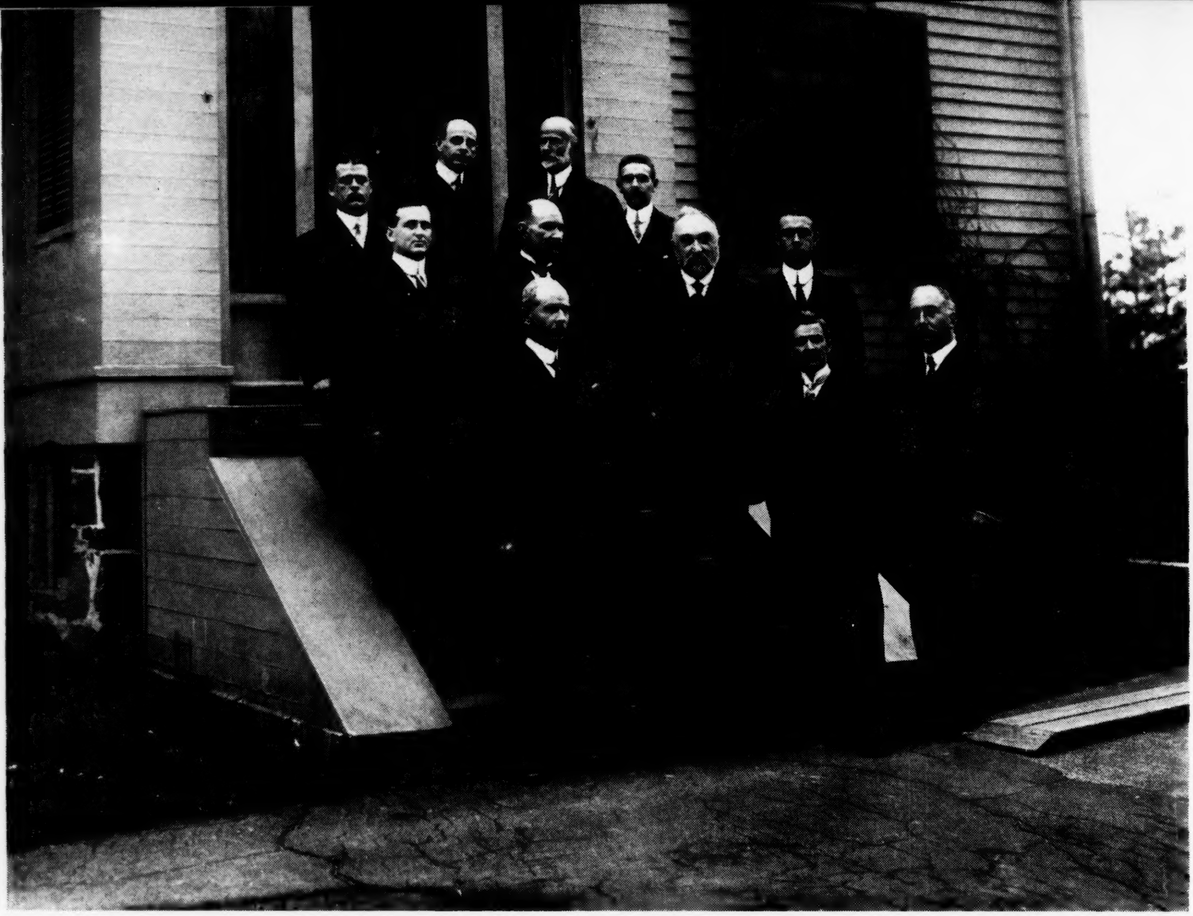
Mr. Feibelman did not have the benefit of Mr. Turco's complete report of the visual solar flare observation which he reported in the last issue, in which the latter observer viewed a bright "flare" well within the disk of the sun, not on its limb. Mr. Feibelman, a well known observer of aurorae and other atmospheric phenomena, interested us with his comments, however, and we should like to excerpt briefly from his report printed in THE OBSERVATORY, *a British journal:*

"I was most interested in Dr. Ohman's recent observations of "Apparent Solar Prominences caused by Jet Planes crossing the Solar Limb." For the past year and a half I have been watching and photographing the green and red flash from a location about 10 miles from Pittsburgh, Penn. On the opposite side of town is the Greater Pittsburgh airport which also serves as a base for some jet planes. Thus, while watching the setting Sun, it frequently happens that all types of airplanes cross the disk of the Sun.

Numerous "surges" of the type described by Dr. Ohmann have been seen and photographed. When a plane, either jet or piston type, is seen near the limb of the Sun, the exhaust gases glow brightly and appear for as long as 2 or 3 seconds. The intensity rivals that of the Sun and one gets the impression that the plane is actually dragging part of the Sun along. The effect has been observed over a wide range of elevation of the Sun, from 25° above the horizon to the last moments before setting."

Mr. Feibelman is associated with the Westinghouse Research Laboratories and the Allegheny Observatory. A photograph by him of this interesting phenomenon is reprinted here.

(Continued on page 27)



Founders of the American Association of Variable Star Observers held first Harvard College Observatory meeting of the organization in November, 1915. (Top row, left to right) A. B. Burbeck, 1st treasurer; David B. Pickering, 1st president; Solon I. Bailey; W. T. Olcott, 1st secretary. (Middle row, left to right) F. H. Spinney; C. Y. McAteer; E. C. Pickering, founder; G. F. Nolty. (Front row, on walk, left to right) Rev. T. C. H. Bouton; Leon Campbell, 1st recorder; J. L. Stewart. Members were posing on steps of Observatory's Building "A", which housed AAVSO for nearly half a century. (AAVSO Photo)

1911-1961

THE STORY OF THE AAVSO

By R. Newton Mayall

Argelander, Pickering, Campbell, and Olcott are names well known in astronomy. Although they are no longer with us, they still live on through their contributions. They, more than any others, are responsible for the founding of the American Association of Variable Star Observers (more familiarly known as AAVSO), which in 1961 is celebrating its 50th anniversary — a half century of achievement.

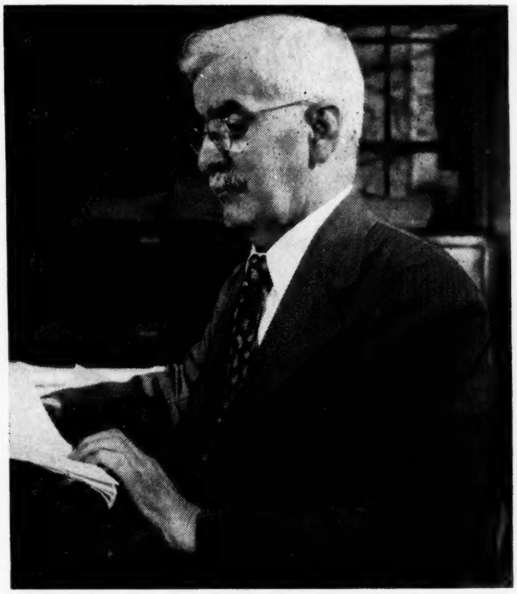
Some of you who read this may not have heard of the AAVSO. The obvious questions are: "What is the AAVSO? What does it do? Why does it do it?" These will be answered in detail as the story unfolds, but there is no harm in answering them briefly now.

The AAVSO is an organization of amateur astronomers, world-wide in scope. Its members observe variable stars, estimate their changing brightness, and send their estimates regularly to the Association headquarters where they are correlated; and the data are then sent to astronomers throughout the world. Because of this wide-spread activity astronomers can obtain regular information on large numbers of stars that it would be well nigh impossible for them to obtain from the relatively few professional observatories. That in a nutshell is what the AAVSO is, what it does, and why it does it. But that is not all, for AAVSO is much more than a stereotyped organization providing scientific data—it is the story of men and women. Let's go back a century or so and follow it through.

Many organizations have what they call their "patron saint." That of the AAVSO is Friedrich Wilhelm August Argelander (1799-1875), a German astronomer, famous for his *Durchmüsterung* star catalog and atlas, which contained the positions of hundreds of thousands of stars down to the 9.5 magnitude. But Argelander also was the first to begin a serious study of those stars whose light had been observed to change—variable stars. He developed a so-called "step method" for reducing estimates of brightness to obtain light curves. The reduction of observations was a laborious task; but observing these

This is the first of two articles covering the history and activities of the AAVSO during the past 50 years. As a long-time member of the AAVSO, a prominent figure in amateur astronomy, and, incidentally, the husband of the present AAVSO recorder, R. Newton Mayall is eminently qualified to put on paper the story of this internationally known and respected organization. Mr. Mayall, with his wife, has co-authored or edited such books as "Sundials," "Skyshooting," "The Sky Observers Guide," and "Field Book of the Skies (Olcott.)" The second article will appear in the next issue.

No person has been more closly identified with the AAVSO during its half-century of existence than Leon Campbell, its first recorder. His warmth and personal touch, whether through personal contact or correspondence, did much to give the sprawling organization its esprit de corps. (Harvard News Service Photo)



stars and estimating their brightness was not.

In 1844, Argelander wrote an article entitled: "An Appeal to the Friends of Astronomy for the making of certain interesting and useful, as well as easily conducted, observations in various branches of Astronomy." He then went on to say: "Therefore do I lay these hitherto sorely neglected variables most pressingly on the heart of all lovers of the starry heavens. May you increase your enjoyment by combining the useful and the pleasant, while you perform an important part towards the increase of human knowledge."

And other astronomers and lovers of the sky did find these stars of interest. In the early 1880's a small group of amateur astronomers in the United States began systematic observations. Among them were Chandler, Parkhurst, Sawyer, Sperra and Yendell — all later to become well known for their work in astronomy and for their discoveries of new variables. There were only 18 known variables in Argelander's time. By 1896 the number had increased to 393.

In 1895 a variable star section was formed in the British Astronomical Association. This section has made continuous observations since then, but their records are published at irregular intervals. All these early observers used the Argelander "step method" for reducing their observations, and the BAA variable star section still uses it.

Prior to 1900 the Harvard College Observatory had become famous for its research in stellar photometry. Its director, Edward C. Pickering (1846-1919) had made over one and one-half million observations with a meridian photometer of his own invention. Pickering's work was of particular importance to variable star astronomy, because it provided reliable magnitudes for groups of comparison stars in the variable star fields. By this means an observer could compare the brightness of the variable with that of several nearby comparison stars whose magnitudes were known. An immediate estimate, to tenths of a magnitude, could be made. But, more important, the observations could be used as soon as made, thereby greatly simplifying the method of reduction. No laborious reductions were required, as in the "step method." For their charts observers used enlargements of Argelander's *Bonner Durchmüsterung* atlas, supplemented with photographs of the regions.

F. W. A. Argelander, famous German astronomer and "patron saint" of the AAVSO. This sketch from the AAVSO archives was made by H. O. Eaton, who often substituted for secretary Olcott in early days.

Leon Campbell, as a young man on the Harvard Observatory staff, together wtih a few other observers, carried out observations with this new method for many years. Among his cooperating observers were Frank Seagrave of Scituate, R. I.: Prof. Anne S. Young of Mt. Holyoke College; Miss Helen M. Swartz of So. Norwalk, Conn.; and Dr. Caroline E. Furness of Vassar College. They sent their observations to the Observatory where Campbell correlated them. In those days there were numerous media that published these observations, such as the *Journal* of the Boston Scientific Society and the old *Popular Astronomy* magazine.

Late in 1909, the American Association for the Advancement of Science held a meeting at Harvard. Attending that meeting was William Tyler Olcott, from Norwich, Conn., who was trained as a lawyer but whose greatest interest was astronomy. With his own telescope he had observed planets, nebulae, clusters, and other objects; and to share his pleasure with others he wrote the

William Tyler Olcott, lawyer, author and amateur of astronomy, at his telescope. Olcott made organization's first observations, continued to lead its expansion through his observing, his writing and his personal enthusiasm. (Monthly Evening Sky Map Photograph)

Field Book of the Stars (1907)—a book about the constellations. At the AAAS meeting, light curves of variable stars under observation at Harvard were on display. This exhibit impressed Olcott, so much so that after returning to Norwich he wrote to the Observatory, asking if he could become a variable star observer. In January 1910, E. C. Pickering gave Campbell leave to go to Norwich to initiate Olcott in the "art of observing variable stars."

The pleasures mentioned by Argelander soon bore fruit in the young Olcott, for he made his first observations on February 1, 1910. These and subsequent observations were sent to Campbell. An article by Olcott appeared in the March 1911 issue of *Popular Astronomy*, entitled "Variable Star Work for the Amateur With a Small Telescope." It was probably the first article of its type ever written. It contained specific instructions for locating and observing variable stars, complete with charts and light curves. In the September 1911 issue, Herbert C. Wilson, editor of *Popular Astronomy*, asked this question: "Can we not have an association of observers with a variable star section, a Jupiter section, etc.?" This idea appealed to Olcott, who forthwith offered his services to organize such a group and edit its "monthly reports." Olcott did not let any grass grow under his feet, for he got in touch with Campbell and Pickering immediately, and with their blessing succeeded in getting the observers to send their reports to him.

The first report of the "American Association of Variable Star Observers" appeared in the November 1911 issue of *Popular Astronomy*. It contained the observations of Olcott and Prof. Anne Young of Mt. Holyoke College. The second report appeared in the December 1911 issue and contained 208 observations contributed by Prof. Young, Miss Helen M. Swartz, and Messrs. Hathorn, Jacob, Vrooman, and Olcott.

THUS THE AAVSO was born. Olcott's offer to take over the responsibility of publishing the reports came at a most opportune time, for Pickering had asked Campbell to go to Harvard's southern station in Peru, where he stayed until 1915. But in the meantime, the reports came out with great regularity, and the number of observers and observations grew. Of great importance was the availability of useful information very shortly after it was obtained and at regular intervals. This was particularly valuable to astronomers everywhere. There was no great lag in publication.

With the growing number of observers, Olcott felt it would be good to get together with as many as possible. As Olcott said: "I wanted to see what they looked like." He arranged a meeting for April 8, 1914 in a restaurant on the south side of 42nd St. in New York City, just west of Madison Avenue. There, under the influence of good fellowship, the AAVSO became a distinct cooperative body. Here were men in the flesh, and plans could be made. Those present at this meeting were:

Lamour Barbour, New York City, N.Y.

Allan B. Burbeck, North Abington, Mass.

Stephen C. Hunter, New Rochelle, N. Y.

Charles Y. McAteer, Pittsburgh, Pa.

Edmund Mills, Jersey City, N. J.

Edmund C. Putman, New York City, N. Y.

William Tyler Olcott, Norwich, Conn.

A similar meeting took place again in the fall of 1914 at the Lorraine Hotel on 5th Avenue. This was the beginning of regular AAVSO spring and fall meetings. The second spring meeting was held in New York 1915, and in October the first of a long series of annual meetings was held at the Harvard Observatory, at the invitation of E. C. Pickering.

Leon Campbell returned in 1915 to find that, under Olcott's leadership, the AAVSO had grown by leaps and bounds and already had observers contributing from the far corners of the world. So too did the number of observations and the number of stars observed grow. The reports in *Popular Astronomy* were becoming voluminous. Olcott had done his work well; but with Campbell back in Cambridge, it was agreed with Pickering that all future reports would be sent to Campbell, who would prepare them for publication, and that Olcott would continue as correspondent.

Olcott loved to write letters and he had made friends both far and near. He felt that meetings were a great boon to the organization. Members became fast friends. But the transfer of responsibility for editing the reports did not lessen the work for Olcott. Like many another fledgling organization, it had its distressing moments. The number of observers was growing faster than Harvard Observatory could provide the charts to be sent to new members.

No more dedicated man could

The home and rooftop observatory of David B. Pickering in East Orange, N. J., as it appeared in 1916. First president of the AAVSO, Pickering (no relation to E. C. Pickering) used a 3½-inch refractor then, later adding a large instrument. (Monthly Evening Sky Map Photograph)

serve an organization than Olcott, as those who knew him can attest. In the first six years he made more than 7,000 tracings from enlargements of the *Durchmüsterung* and from photographic charts, which he distributed to the observers. In Olcott's own words: "They were awful to look at, but were accurate, which was most fortunate." As a result more than 80,000 observations were made during the six years. These were published in *Popular Astronomy* and filed at Harvard Observatory.

The Harvard Observatory, through Pickering and Campbell, fostered a close relation with AAVSO observers—a pleasant and profitable relation to both—that is retained to this day. Harvard Observatory and its staff were the guiding hand of science and the depository of the work of its children.

During this early period another Pickering appeared on the scene—David B. Pickering of East Orange, N. J. He was a good observer, jovial, friendly and generous. From 1916 to 1920, spring meetings were held at his home. Dave, as everyone called him, loved the AAVSO as Olcott did. Everyone was known by his first name, and many were given to writing humorous poetry — particularly Dave and Olcott. The following poem is a good sample; but humorous as it is, it shows the impact already made by the AAVSO as an observing organization. Dave read the poem at the 1920 spring meeting held at the Uptown Club in New York.

A. A. V. S. O.

Said SS Aurigae to U Geminorum—
"They're learning more about us than their fathers knew before 'em."
Said SU Tauri—"Can our secret be uncovered?"
Said R Cor Bor—"We're lost if we're discovered."
Then up rose SS Cygni—he was bright and white and high—
Standing full 8.2 on the rostrum of the sky.
As the Dean of stellar sages he was far above the others,
And his beam seemed to break as he addressed his weaker brothers:
"We might as well give up, for whether hiding high or low,
We cannot escape the vigils of the A. A. V. S. O."
Then with breathless voice they murmured, "Do you think there's any hope?"
And he said—"I see the spectre of a dreadful spectroscope."
Hearing this, the fainter brothers seemed to be so overcome
That they sank into their places, down almost to minimum.
And just before the sun arose, they heard old Mira shout—
"The Telescopes will get you
if you
don't
watch
out."

David B. Pickering
New York, May 8, 1920.

BY 1917 THE AAVSO had proved its worth. Its members had become expert observers, piling up an enviable record both as to quality and quantity. It was time to organize formally the widely scattered membership. At the annual meeting of the Association held at Harvard Observatory November 10, 1917, action was taken to incorporate under the laws of the Commonwealth of Massachusetts. The following members were elected to office:

President: David B. Pickering, East Orange, N. J.

Vice-Pres.: Harry C. Bancroft, New York City, N. Y.

Treasurer: Allan B. Burbeck, N. Abington, Mass.

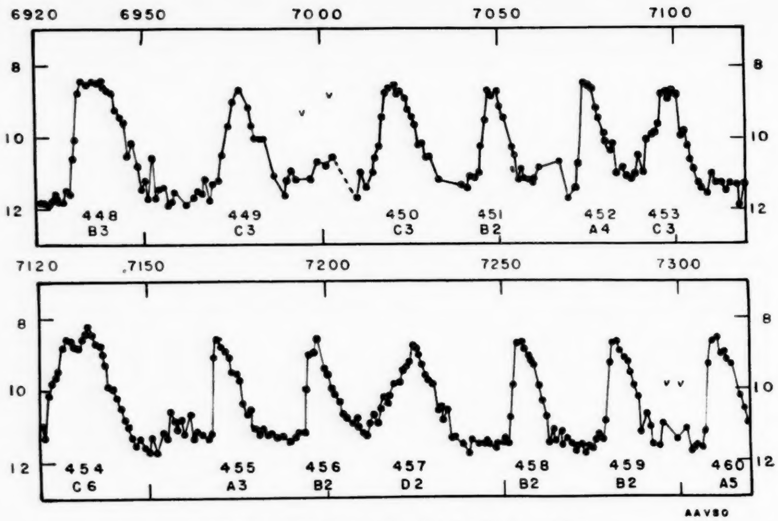
Secretary: William T. Olcott, Norwich, Conn.

A constitution and by-laws were adopted, and the charter forming the AAVSO as an independent corporate entity was received from the Secretary of the Commonwealth, dated November 15, 1918, marking the beginning of a remarkable growth and achievement.

Harvard College offered its facilities for headquarters of the Association, and Leon Campbell became the official recording secretary, although he always signed his letters and reports as "Recorder." The contributions of the Association's members were particularly valuable to the Harvard Observatory.

The AAVSO looks to Edward C. Pickering as its founder and honors him with a bronze plaque at its headquarters, and his portrait on the wall continues to watch over its activities.

Pickering died in 1919 and Solon I. Bailey became acting director. In



MEAN LIGHT CURVE OF SS CYGNI, 1960

The erratic variable SS Cygni, whose rise from 12th to 8th magnitude often brings irregularities, is one of the most-observed of AAVSO stars. Numbers at top of graphs indicated elapsed Julian Day number-dates; numbers and characters below curves show epoch of each maximum and its type. For further information on variable star observing, see "Through the Three-Inch," page 22.

1920, a young man from Mt. Wilson named Harlow Shapley arrived in Cambridge, and in 1921 he was appointed director of the Observatory. What would a new broom do?

Fortunately, Shapley saw in the AAVSO a great potential, and a reservoir of good observers capable of doing more than just observing variable stars. He provided a special room where everything pertaining to AAVSO would be housed; and in the small dome atop the building was mounted the Post 6″ refractor, which had been given to the Association.

This did not solve all the problems, for the number of observations and number of stars observed had grown to such proportions that assistance at Headquarters was badly needed to keep up with the volume. The value of reports published monthly—and as soon as possible after receipt—was of great benefit to members and was of particular value to astronomers. So voluminous had the reports become they were a burden to *Popular Astronomy* and a burden on the finances of the organization. With the continuity of published reports in jeopardy, Shapley provided an assistant and offered to have the reports printed quarterly in the Harvard *Annals*, together with brief notes on variables and the AAVSO. And so the ties with Harvard Observatory became closer.

In 1925 the AAVSO began a drive for $100,000 for two purposes: (1) to be independent, and (2) to honor its founder by establishing the Edward C. Pickering Memorial Fund to promote the cause of variable star astronomy. By the time the Association had raised about $7,000, Shapley suggested that the money be turned over to the Observatory Development Fund which, together with other matching funds, would provide a quick realization of the goal of $100,000. This was done and in 1931 the Association's first Recorder was made Pickering Memorial Astronomer at Harvard Observatory, his salary being paid out of the income from the Pickering Fund.

The establishment of the Fund and the inclusion of the contributions of the AAVSO in the Harvard *Annals* did much to perpetuate the work of this branch of astronomy. Through Shapley's interest in the Association, it continued to hold its annual meetings at HCO. Amplified by the presence of members of the staff, they were memorable occasions. At these meetings the amateur could talk over his problems with the professional. Mrs. Shapley presided over bounteous teas on the terrace of their home. With such a widely scattered membership it was impossible for all members to attend these meetings.

By 1920 the spring meetings had been getting too big for Dave Pickering's home, so the idea of a roving spring meeting was instituted. The first roving meeting was held at Vassar College at the invitation of Caroline E. Furness. Here was set the format for all meetings—a serious part, a social part, and a good dinner. We became a family and each meeting was like a homecoming. The roving spring meetings gave the opportunity for more members to attend and meet.

From the very beginning the AAVSO established an *esprit de corps* that has never diminished. Its members were serious-minded and were faithful to their observing; but with it all there was built up a great bond of friendship, even among those who were never destined to meet.

Although the professional astronomer has had much to do with the AAVSO's success, he never has tried to dominate it. It is basically an amateur astronomical organization and its business affairs have been run by the amateur. From time to time, a professional astronomer has become its president; and many of them have sat, and do sit now, on its council.

This close association with the professional has meant more to the AAVSO than just a routine relationship. Many of our scientists and well-known astronomers of today had their interest in science sparked by the AAVSO, and they continue their support long years after they have given up their observing in favor of other fields of research.

As time went on Leon Campbell's efforts were entirely devoted to the AAVSO, culminating in his *Studies of Long Period Variables*, a standard reference work made possible by the contributions of members of the AAVSO. In 1949 Harvard honored him with a Master of Arts degree.

In 1949, the time had come for Leon Campbell to retire. He had nurtured many an amateur in the ways of variable stars, some of whom he watched grow up and become famous in their fields. The accumulation of data through the years had made many changes in the work necessary and valuable research material was on file. The work of correlating and using the records was in the hands of the professional; therefore, upon Campbell's nomination, the AAVSO Council selected another professional astronomer to

fill the vacant chair. This was Margaret Walton Mayall, who had been associated with the famous Harvard astronomer Miss Annie J. Cannon and who worked with her on the *Henry Draper Catalog* of stellar spectra. Mrs. Mayall completed the *Henry Draper Extension*, which was published as the Cannon Memorial volume of the Harvard *Annals*.

Mrs. Mayall liked the amateur. She had been a member of the AAVSO for many years and at one time was its chart curator. In 1949 she became the AAVSO's second Recorder and Pickering Memorial Astronomer. The Recorder was the official representative of the AAVSO at all scientific and astronomical society meetings, and was the representative in the International Astronomical Union. Mrs. Mayall already was a member of the spectral commission in the IAU, and she filled Campbell's post on the variable star commission. In general there were few problems involved and few changes to be made. More stars were added to the program, a new system of correlating data was established, and on the approval of astronomers a new system of publication was adopted.

Margaret Walton Mayall, who became the AAVSO's second recorder in 1949 upon the retirement of Leon Campbell. This informal photograph was made at Madison convention of Astronomical League in July, 1954.

ALL WENT WELL until 1952. Shapley had retired and Dr. Donald Menzel became director. Menzel has been a member of the AAVSO since his student days, during which time he had been a constant visitor at the Campbell home. He had specialized in solar physics, but had not lost interest in variables. But, like many others in similar situations, he found himself faced with some old buildings that needed extensive repairs. This being impractical they were recommended for razing and replacement. One housed the AAVSO headquarters; in fact, the AAVSO occupied nearly the whole of Harvard's Building "A". This, together with the aftermath of a world war which brought with it an accelerated program in other fields of astronomy, meant that the AAVSO had to move. Moving was not a grave problem, but with it came the announcement that there would not be room for the organization in the remaining buildings, and the Recorder would no longer be Pickering Memorial Astronomer, because the Pickering Fund would have to be used for purposes other than variable stars.

This was a blow to the Association, which had felt itself secure. There it was, a going organization, with no place to go; and no money to go on. Surely an organizaton that had made such an enviable record and whose services would be required more and more would not be allowed to die. And it didn't — a new era began.

(Concluded in next issue)

AAVSO Anniversary Meeting

The annual Harvard College Observatory meeting of the AAVSO will celebrate the organization's 50th anniversary this fall when members and guests meet in Cambridge on Oct. 12-15. Aside from paper sessions by members and a projected symposium, the AAVSOers will visit the new facilities of the Smithsonian Astrophysical Observatory and the nearby Agassiz Station of the Harvard College Observatory. Saturday morning will feature an historical session which will include movies of previous meetings dating back to the 30's. A tea will be held in the main library of the Observatory.

The official banquet. which will "serve up" Dr. Harlow Shapley as its *piece de resistance*, will be held on Friday evening, Oct. 14th. Dr. Shapley, whose annual survey of the highlights of the year in astronomy has become a regular feature of the fall meetings, will revise his routine this year to cover the astronomical highlights of the last half century. Reminiscences by long-time AAVSO members will also be a part of the program.

DID YOU KNOW THAT . . .

By Patrick V. Rizzo

The most successful discoverer of comets in the history of astronomy began his observatory career as a doorman in 1789.

He was Jean Louis Pons, who found 37 comets. not counting "recoveries". The directors of the observatory in Marseilles. where he was employed, gave him lessons in astronomy.

However, Pons did not use the observatory telescopes in his cometary discoveries. He made both the telescopes and the lenses for this work himself.

Of all the comets found in the first 25 years of the 19th century, he was discoverer or co-discoverer of three-fourths. Not all that he discovered bear his name. Three famous ones, comets Crommelin, Encke and Biela, were named after other astronomers who did computing on their orbits.

In recognition of his discoveries Pons was promoted in 1813 to the post of assistant astronomer at the Marseilles Observatory. Once he had found five comets within eight months from February to September, 1808.

In 1819, Her Majesty Maria Louisa of Bourdon, appointed him director of a new observatory near the city of Lucca, in Tuscany, where he discovered 7 comets. The queen offered a cash prize for comet discoveries and Pons obliged by finding a comet immediately upon his arrival at the observatory.

(This is reminiscent of an event that happened at the Dudley Observatory in Albany, N. Y. The Board of Visitors came upon Director Boss doing some desk work. They hinted that perhaps the finding of a comet might enhance the reputation of the observatory more than the work he was doing. He hinted in return that nothing could be easier than finding a comet if they were willing to pay a person for the time used in the search. They accepted the challenge by handing over the money and a short time later Professor Boss handed over a newly discovered comet!)

THE "BIG FOUR" ASTERIODS

By Armand Spitz

THE EARTH HAS several thousand neighbors in the solar system—the minor planets, or, as they are better known—asteroids. Like the earth and the other eight generally recognized planets, the asteroids travel in orbits around the sun. They are members of the solar system, and might be called primary members to distinguish them from the secondary members, or satellites, that travel in orbits around the planets, which are in turn traveling around the sun.

It was only a hundred and fifty years ago that nobody in the world had any idea that these tiny objects existed. A few astronomers, it is true, were hunting for a planet which they *thought* was missing. Hunting for one, they found a thousand, more or less.

An interesting series of numbers was brought to the attention of the world by J. E. Bode in 1772. It is popularly known as Bode's law, although it had been advanced by John Daniel Titius, of Wittenberg, some years before. It suggested that a series of ten 4's be set down. Let the first be taken without addition; to the second add 3, to the third add twice 3, or 6, to the fourth add twice 6, or 12, to the others add 24, 48, 96, 192, 384 and 768. It was suggested that these sums, taking the earth's distance from the sun as the unit, would indicate fairly accurately the respective distances of the planets from the sun.

That the Bode idea was intriguing is shown by a comparison of the computed distances with actual distances, keeping in mind that Mercury, Venus, Mars, Jupiter and Saturn were then the only planets known. The following table indicates the coincidence:

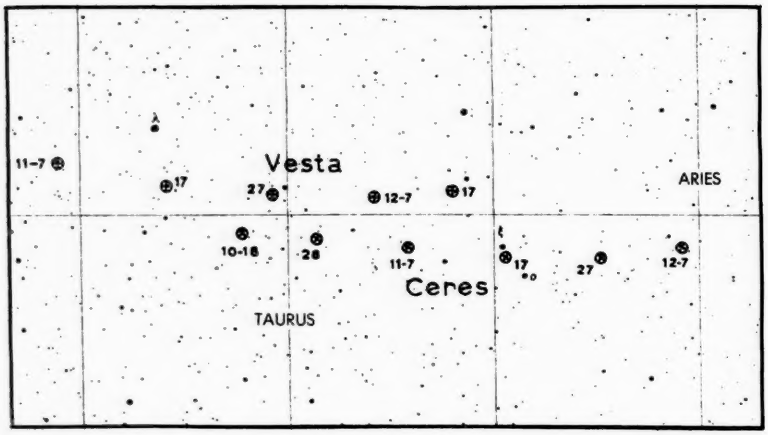
Planet	Bode's Law	Actual Distance
Mercury	0.4	0.387 A.U.
Venus	0.7	0.723
Earth	1.0	1.000
Mars	1.6	1.524
	2.8	
Jupiter	5.2	5.203
Saturn	10.0	9.539

When Uranus was discovered, there was not too great a discrepancy between the Bode computation of 19.6 and the observed 19.19. However, with the discovery of Neptune, the Bode law fell down completely, the theoretical distance being 38.8, and the observed distance being 30.07. Long ago it was concluded that the ratio was merely a chance coincidence, and the discovery of Pluto added further evidence to justify this conclusion. If Bode's law worked, it should have been about 77 A.U.'s distant from the sun. As a matter of fact it is less than 40 units distant.

For the moment, however, let us travel back to the late 1700's, when people were conscious that new objects could be found in the solar system. Had not Herschel only recently found Uranus? Did it not fit in with the Bode law idea? Was there not, in the table, an unexplained gap between Mars and Jupiter, where the law said there should be a planet, but none was known? A gap of more than 340 million miles, where there certainly should be a planet, and wasn't! Twenty-four astronomers therefore organized a search in "tracking" and intercepting the fugitive subject of the sun.

One constellation of the zodiac was assigned to each pair of observers, so that they could work together, and by checking results with each other, be sure of accurate results. They realized that the planet would present much the same appearance as a star. That is the reason they were called "asteroids" having the form of a star). They therefore watched for motion.

On the first night of the 19th century, January 1, 1801, success came to an Italian astronomer, Piazzi. For ten years he had been making charts of a small area of the sky which he was studying. On that night he saw a tiny object and marked its position on the chart. The following night he went back to compare drawings, and noted an almost imperceptible shift. Night after night he watched, and found that it was, indeed, moving. Although for all those years he had been hunting for a planet it never occurred to him that maybe this was the planet. He



The ten-day predicted positions for minor planets Vesta and Ceres are plotted on this adaptation from the Beyer-Graff "Stern-Atlas" for several weeks before and after opposition. See "Minor Planet Notes" for further data. (North is at the top.)

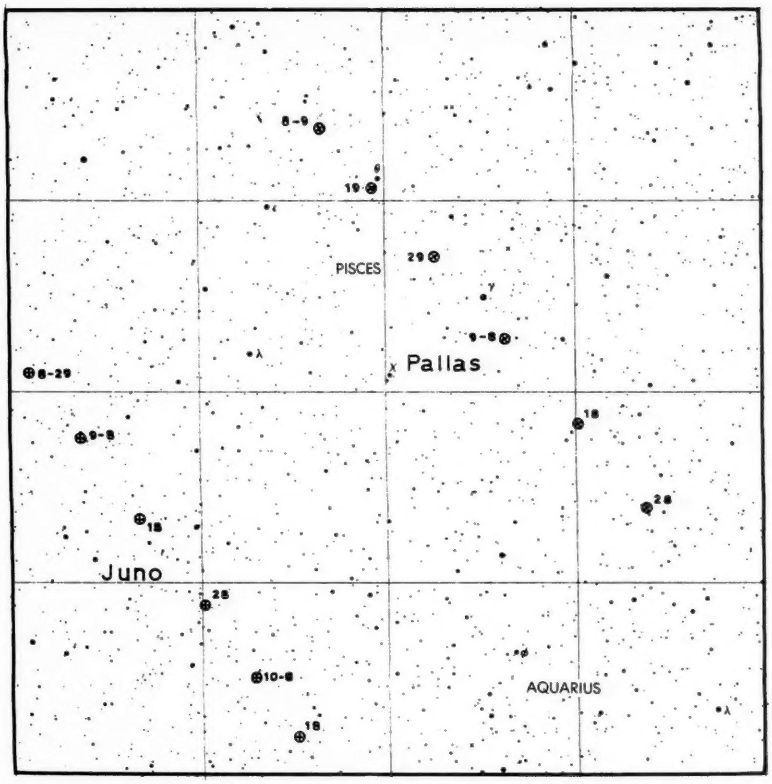
thought, instead, that it must be a comet without a tail. He wrote to friends in Berlin and in Milan, and told them to look for the comet. The mails were slow in those days—Piazzi's friends didn't receive the letters until several weeks later. In the meantime, Piazzi became very ill, and had to stop his observations. In additon, the sun and the tiny object drew closer together so that it became invisible.

Gauss, another of the interested astronomers, reasoned that, since Piazzi saw it in definite places in January and February, he could compute where it would be at some later time. He asked all astronomers to study a certain area on a given evening. On the very night Gauss named there was a heavy mist at nightfall, settling in to sleet and rain, and clouds covered the skies for some evenings afterward. However, on the last night of the year, it was rediscovered, and has never been lost since then.

Piazzi called his planet Ceres Ferdinandea, in honor of the goddess who watched over Sicily, and Ferdinand, the King of Naples. Ceres, as it is now known — the largest of these baby planets — is less than 500 miles in diameter. Nevertheless, it is a monster in comparison with the other asteroids, for it is more than half again as big as the next biggest.

At first it was thought that the search for the missing planet had been successfully concluded. But, only two months after the rediscovery of Ceres, another was found. This was named Pallas. It was suggested that, at one time, there may have been only one, and it had exploded, breaking into two pieces. This theory was strengthened within the next two years, for two more asteroids were found, both smaller. These were named Juno and Vesta. Then the searchers must have been satisfied, having found four planets in place of the one they expected, for no more were discovered until 1845, when a postmaster named Hencke found one, and, about eighteen months later, another. This started a new wave of interest, and they began to be discovered with speeds—sometimes 50 or 100 new ones a year. They are now numbered in the thousands.

For the most part, they are very small objects in comparison with the earth, not much bigger, perhaps, than a mountain, and yet each one of them follows its own regular orbit in space, traveling around the sun as a member of the solar system.



In this chart for Pallas and Juno, as in the chart on the opposite page, each square covers 5° of declination and 40m of right ascension. Largest stars are about 4th magnitude, smallest 9th magnitude. Chart coordinates are not shown to avoid confusion; positions have been adjusted to allow for precession since 1855 epoch of Beyer-Graff charts.

MINOR PLANET NOTES

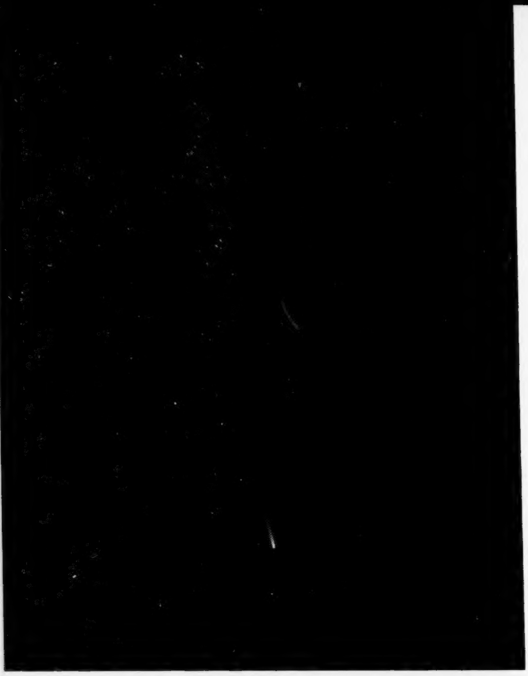
THE NEXT FEW MONTHS offer a rare feast—the "Big Four" asteroids, Ceres, Juno, Pallas and Vesta, all come into opposition within ten weeks of each other. This is certainly a time for new observers to become familiar with the fascinating field of asteroid-tracking—and for experienced telescopists to sharpen their claws.

The ephemerides used for the charts of the four minor planets on these pages were furnished by the International Astronomical Union's Minor Planet Center at the University of Cincinnati Observatory through the courtesy of Dr. Paul Herget. They differ slightly in position and opposition date and brightness from those published in the BAA *Handbook* and the *American Ephemeris and Nautical Almanac*, but not sufficiently to cause any concern. Residual errors will be canceled out by the scale and rough plotting of the accompanying charts.

The brighter and designated stars on the charts should be located on a star chart such as Norton's or Becvar's for orientation. Observers will notice that Pallas will pass through the familiar "Circlet" in Pisces during its approach to opposition, making it especially "easy pickings" at that time. Pallas is in opposition on Sept. 7th, its predicted magnitude being a faint 9.3; Juno, Sept. 7th, 8.5; Ceres, Nov. 14th, 7.5; and Vesta, Nov. 20th, 7.3.

Being faint, Pallas and Juno may have to be checked for motion to confirm your finds, but Ceres and Vesta should be conspicuous in their star fields. Motions of the objects will be retrograde east to west as is always the case at time of opposition.

For further information on asteroids and asteroid-hunting, we recommend the chapter on minor planets and appendix material in the Mentor paper-back book, *Handbook of the Heavens*, obtainable at most quality newsstands.



This nine-minute exposure of Comet Wilson made by Alan McClure just before his cover photo on July 25th gives better picture of the object's well-defined tail. Comet's brightness was short-lived as its daily motion carried it away from earth and sun. Photo was made with 7" e.f.l. f/7 Fecker triplet lens, using blue sensitive plate. McClure reported comet to be low in the sky, but transparency was excellent down to 5° from his Mt. Pinos vantage point.

COMET REPORT

COMET WILSON

By David D. Meisel

On the morning of July 23rd, while searching for Mercury with a pair of binoculars, A. Stewart Wilson of Seattle, Wash., sighted a faint streak of light extending from the horizon to the star Theta in the constellation of Auriga. Later the head of the comet rose and Mr. Wilson, a navigator for Pan-American Airways, obtained a rough position of the comet. This position was then relayed to Harvard College Observatory, the official comet "clearing house" for the western hemisphere. The comet was estimated to be about 3rd magnitude, with at least a 15° tail.

Accurate positions were first obtained by Hubbard and van Biesbroeck at the McDonald Observatory in Fort Davis, Texas. In addition, several further independent observations were reported to Harvard by various observers around the globe. (It is interesting to note that almost all of the initial reports received by the A.L.P.O. Comets Section were made from the western part of the United States. This is indicative of the unsavory weather conditions in the East during the summer!) Unfortunately, because of the entrance of the moon into the morning sky three days after discovery, Comet Wilson was actually very poorly observed from the standpoint of photographic analysis of its tail structure and its evolution over a long period of time. Hence, the more valuable physical observations were made on the 24th, the 25th, and the 26th of July. Of note in this respect are the photographs made by Alan McClure of Los Angeles, Calif.

From an altitude of 8,800 feet on the mountain of Mt. Pinos, Mr. McClure obtained photographs showing the tremendous extent of the tail structure. Also evident is the anti-tail, first reported by van Biesbroeck.

The photograph shows the inner structure of the main tail with its rays and streamers, and the "beard" of the anti-tail is also very evident. At this time the comet was reported by McClure and others as being of

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METEOR FRAGMENTS

SOME SHOWERS IN STORE

E. E. Friton
Regional Director, AMS

Although there are no permanent meteor showers of any note during September, observing should be done in order to preserve continuity and to detect any new shower which may appear. Such a shower can come at any time whatsoever, as planetary perturbations of new or of old unrecorded streams could cause an unexpected shower to appear.

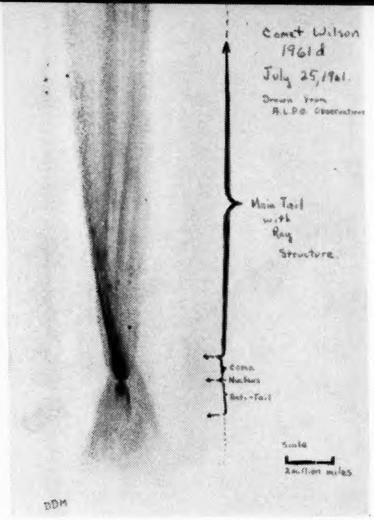
Some watch should be made on the nights of October 8/9, 9/10, and 10/11 for unexpected activity of the Draconids (or Giacobinids, from Giacobini's Comet). These have a 6- to 7-year period. A very rich shower was seen in 1933, practically nothing in 1939 and 1940, then another rich display in 1946. A strong radio-echo shower was noted during the daylight hours in 1952, but practically nothing at night. In 1959, Dr. C. P. Olivier, president of the American Meteor Society, reported that no appreciable shower occurred, according to reports he had received. The shower is of such short duration (2 to 5 hours) that it is easily missed because of daylight, cloudiness, or lack of complete enough observer surveillance all the way around the earth. Also, by 1959, perturbations had pulled the narrow stream sufficiently off course that it was practically out of range at the time of our crosing the node, or point where the earth is at the time it is crossing the plane of the stream's orbit.

The Orionids, unfortunately, will be mostly "mooned out," as the maximum is on the 20th at about 1:00 a.m. CST, while the full moon occurs on the 23rd. However, a treat may be in store for those who can and are willing to observe in the early morning — the post-maximum hours from moonset at 2:12 a.m. CST (Lat. 40 N.) until about 4:30 a.m., when morning twilight will be too far along for good observing. The maximum rate is about 25 meteors per hour, and the duration is about eight days for the shower, according to P. M. Millman in *The Observer's Handbook* of the Royal Astronomical Society of Canada. The radiant is at 6h 20m RA, and 15° N Dec., which is about 9 degrees northeast of Betelgeuze. Culmination (highest in the sky, and at the same time due south) occurs at 4 a.m. CST. The meteors are very attractive, as they are swift and leave streaks.

At the end of October, one may begin to see the Epsilon Taurids, which occasionally produce very slow fireballs. Their radiant is near 4h 16m RA, 22° N. Dec. Additionally, the e Taurids may appear; these are also slow and fireball-producing. The radiant is at 3h 40m RA, 14° N. Dec.

* * *

At present the writer is serving a number of states besides his regular region of Missouri and Southern Illinois, since our most able Great Plains regional director, Mr. Walter S. Houston, transferred from Manhattan, Kansas, to Middletown, Connecticut, recently. Anyone who needs help, or wishes to turn in observations of meteors or report meteorites from the Great Plains Region, will receive a grateful welcome here until a new regional director can be found for that area.



This composite sketch of Comet Wilson by Mr. Meisel, made from photographic and visual observations by ALPO observers, shows details of the rayed structure of the main tail, coma, nucleus and the fan-shaped anti-tail. Comet is now a telescopic object.

about 3rd magnitude but fading rapidly. Three days later the object was reported as 5th magnitude and still fading. By the end of August and the first of September telescopic aid will be needed to see it.

According to an ephemeris calculated by M. P. Candy of the British Astronomical Association, when the photographs were taken on July 25th by McClure, the comet was some 60 million miles from the sun and about 39 million miles from the earth. The main tail at this time had a length of some 18 million miles, while the anti-tail had a length of some two million miles. The widths of the main tail were about 650,000 miles at the coma (head of the comet) and 1,500,000 miles at its farthest visible extremity. During the first week of August, moonlight has hampered observations, and owing to the poor weather conditions, few observations have been received by the ALPO comets section from amateur observers. All observers are encouraged to transmit their observations to the writer at 800 8th St., Fairmont, W. Va. for further evaluation and study of this interesting object.

ASTRONOMERS OPPOSE "SPACE CONTAMINATION"

The American Astronomical Society, the professional body of American astronomers, has taken a stand "strongly opposing any contamination of space that is detrimental to the conduct of basic scientific research." A resolution adopted by the Society at its annual business meeting at Nantucket, Mass., on June 20th, discussed and expressed concern over Project West Ford, in which is it proposed to orbit a belt of tiny, needle-like "dipoles" about the earth. The purpose of the belt would be to "bounce" radio waves for communications experiments.

Investigation by the astronomers indicated that, as proposed, the first belt would barely be detectable by ground-based optical and radio telescopes, but that it could pose a threat to "delicate and important observations" made from orbiting satellite observatories which are scheduled to be launched in the next few years. Additionally, the scientists warned that the expected gains in the sensitivity of astronomical measurement in the next few years might turn the marginal effects of the first belt of Project West Ford into a serious threat.

In its resolution the AAS stated that it is "even more gravely concerned" with future belts in the West Ford experiment and the irreversible damages which such belts might cause. The statement also called attention to "the interference that can be expected from proposed systems of passive and active communication satellites," such as the Echo balloons and similar bright objects which might be launched in great number.

The formal resolution, which was approved by the Society members, closed with the following specific points:

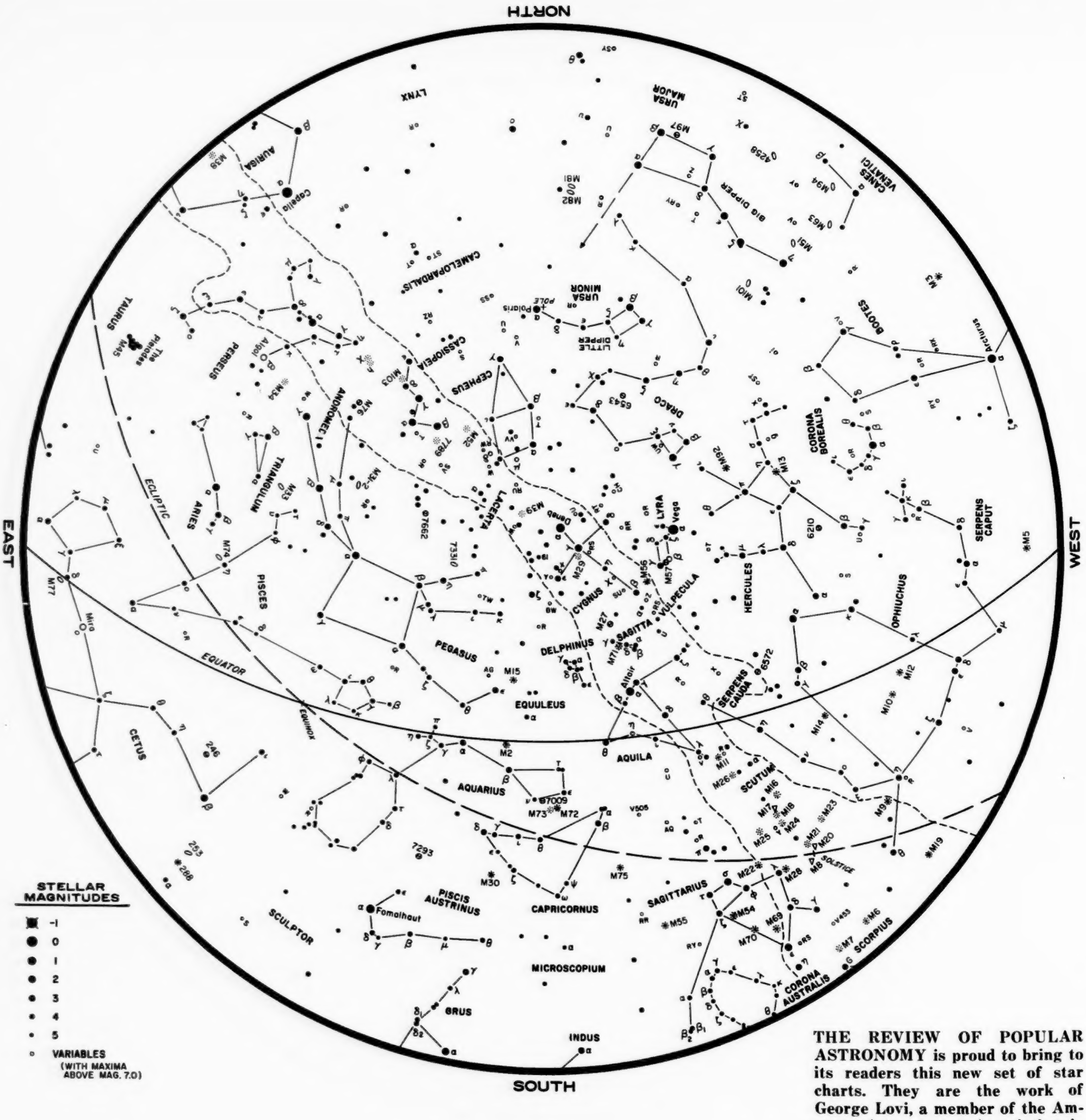
"1. The American Astronomical Society strongly opposes any contamination of space that is detrimental to the conduct of basic scientific research.

2. The Society reaffirms its previous resolution in support of world-wide frequency allocations for radio astronomy as a matter of great and increased urgency."

[EDITOR'S NOTE: *For background information on this important matter, readers are referred to the July-August 1961 issue of* THE REVIEW OF POPULAR ASTRONOMY, *which included an article by Mr. Alan McClure on this subject. His article, "The Vanishing Sky," was based on extensive research and correspondence with many of the professional astronomers who had a part in phrasing the AAS resolution.*

We had an opportunity to read copies of more than a dozen of these letters, many of which were not available for direct quotation within the article. Each letter expressed the scientist's personal concern over some of the space projects which are being considered for development in the near future.]

Memphis Museum visitors view telescope-making exhibit furnished by Memphis Astronomical Society. Designed and constructed by members J. C. Flippin, S. A. McBroom and A. C. Emery, the exhibit features "cutaway" reflector, pitch lap, grinding materials and partly parabolized 6-inch mirror. (Memphis Commercial-Appeal Photo)

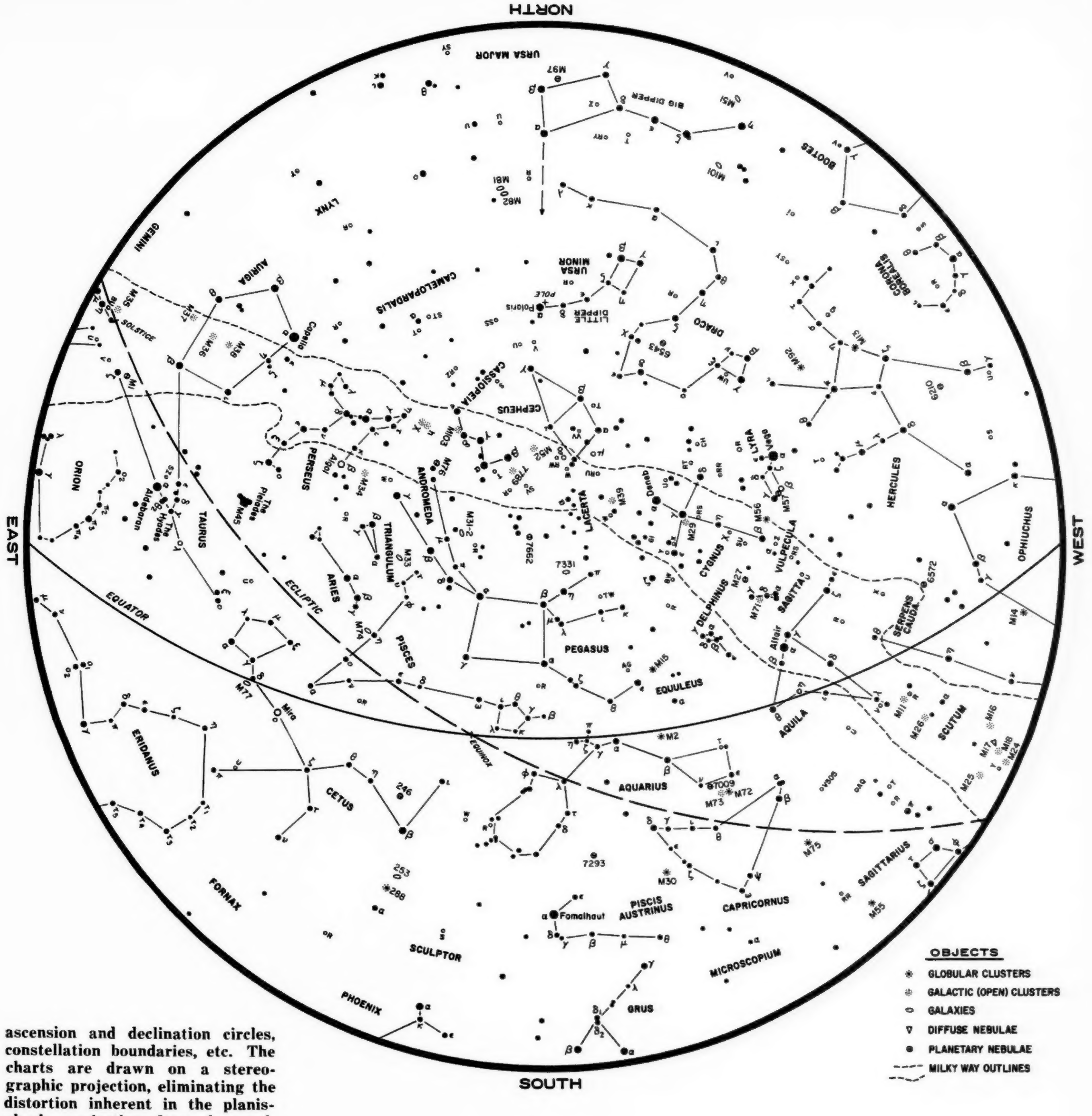


SKY MAP FOR SEPTEMBER

Sept. 1, 10:30 P.M. **Sept. 15, 9:30 P.M.** **Sept. 30, 8:30 P.M.**

(Local Standard Time)

THE REVIEW OF POPULAR ASTRONOMY is proud to bring to its readers this new set of star charts. They are the work of George Lovi, a member of the Amateur Astronomers Association in New York and a technical draftsman. Developed in consultation with the editors, these charts are designed to furnish the amateur, in a clear and accurate manner, all information appropriate to the purpose of such a chart. Clutter has been minimized by elimination of unfamiliar star names, right



ascension and declination circles, constellation boundaries, etc. The charts are drawn on a stereographic projection, eliminating the distortion inherent in the planispheric projection formerly used. The charts are designed for 40° north latitude, but are useful 10° north or south of that latitude. All stars to magnitude 4.49 are plotted (plus a few fainter stars), as are all variable stars with maximum brighter than 7.0, all Messier objects and the more conspicuous NGC objects.

SKY MAP FOR OCTOBER

Oct. 1, 10:30 P.M. **Oct. 15, 9:30 P.M.** **Oct. 31, 8:30 P.M.**

(Local Standard Time)

Part of the group of touring amateurs at the 15th annual meeting of the Astronomical League in Detroit inspect the 85-foot radio telescope at the University of Michigan's Peach Mountain station. Primary work of this instrument at present is in field of continuous observation of the sun. Visitors were astonished when told that the big dish could resolve bright radio sources at 3 centimeters with an accuracy of 30 seconds of arc.

ASTRONOMICAL LEAGUE AT DETROIT

More than 300 amateur astronomers and their families attended the 15th annual convention of the Astronomical League held in Detroit on July 1st through 3rd. Business meetings, paper sessions, addresses, field trips and a banquet made up the three-day event that has come to be an astronomical highlight of the year for hundreds of members of League-affiliated organizations.

The sessions were preceded on June 30th by a meeting of the Council and general conviviality on the part of arriving delegates. Host for the convention was the Detroit Astronomical Society, and its convention committee, under the chairmanship of C. D. "Doc" Marshall, functioned coolly and efficiently throughout the long weekend. Headquarters for the meetings was the Henrose Hotel in downtown Detroit, where the amateurs managed to hold their own against a deluge of square dancers also meeting in protracted session.

Exhibit facilities were excellent and convenient to the meeting room. Several amateur groups and a number of manufacturers of astronomical equipment were on hand with exhibits, and the room soon became a catalyst to continuing bull-sessions in between regular sessions and after—usually long into the night.

The convention was officially opened on Saturday morning under the gavel of president-elect Norman Dalke, who then introduced Dr. W. E. Howard from the University of Michigan's radio-telescope observatory. Dr. Howard discussed the subject "Radio Waves from our Galaxy," and illustrated his talk with slides. This was an excellent preview of the afternoon's field trip to the Peach Mountain site which had been arranged by program chairman E. C. Balch.

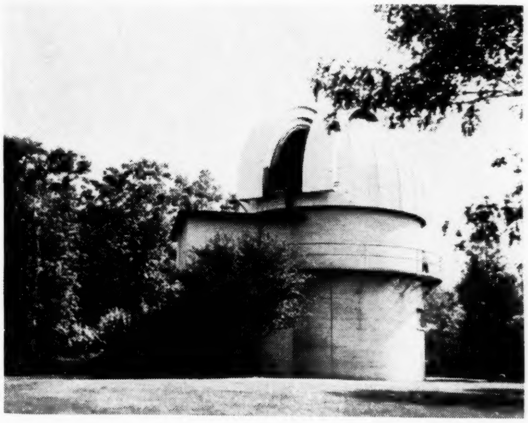
A fleet of buses carried the delegates to the field station, which was some 50 miles northwest of Detroit. The limited laboratory space of the radio facility did not allow the amateurs to inspect the equipment directly, but picture windows and the explanations of staff members gave viewers a good idea of the functions of the various pieces of electronic and measuring equipment within. All visitors were impressed with the smooth motion and close parabolic tolerances of the 85-foot radio telescope's mounting and "dish." Despite the heat and other obstacles (see Convention Sidelights) the field-trippers moved on to the nearby Portage Lake observatory of the University of Michigan for an inspection of the large Schmidt telescope.

Guests were free for the evening on Saturday, but the Detroit group arranged for shuttle buses to pick up delegates during the evening and take them to the Society's headquarters and optical workshop. The headquarters are located in a city-owned building which, although old, offers excellent facilities for the amateurs, especially the telescope makers. Aside from meeting rooms and a lounge and snack bar, the ATM's have separate rooms for each step in the mirror grinding, polishing, testing

Dr. Helen Sawyer Hogg of the David Dunlap Observatory, featured speaker at the League convention, chats with organization president Norman Dalke during lull preceding official banquet. Earlier Dr. Hogg outlined the current work in astronomy in Canada.

Walter Haas, director of the American Association of Lunar and Planetary Observers, which held its meetings in conjunction with the League, congratulates Clark Chapman of Buffalo on his award for exceptional achievement in developing new techniques for planetary observation and cartography.

Lone amateur climbs to slit of Portage Lake Schmidt dome for better view while others inspect instrument within. This optical observatory was a part of the convention field trip, which included visit to nearby radio telescope installations.



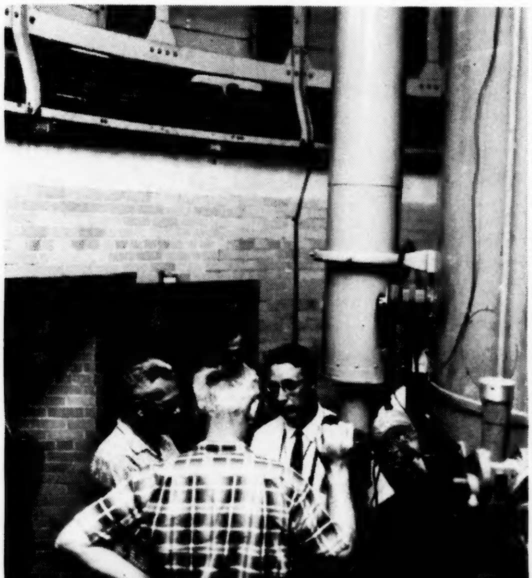
and figuring process. A quick tour of the headquarters indicated that the members, under the guidance of Charles Brisley and other experienced workers, were making productive use of the facilities.

Unfortunately, a star party planned for that evening was clouded out, but conventioneering amateurs have come to take such blights in their stride.

Sunday morning and afternoon were devoted to a meeting and paper session of the Association of Lunar and Planetary Observers, chaired by ALPO director Walter Haas. David Meisel informed delegates of the increasing availability of comet information through the comets section of the ALPO, and Jim Mullaney and George Doschek of Pittsburgh spoke on a "large aperture confirmation service" available through the Allegheny Observatory of that city. Mullaney, who is on the staff of the observatory, announced that he and other staff members are ready to confirm new discoveries with the various large instruments at their disposal. Gary Wegner delivered a paper on spectroscopic studies he had made of color variations among lunar features, an article on which will appear in the next issue of this magazine. William Shawcross briefly and effectively reminded the amateurs of the limited value of much observational work if it is not properly reduced and weighted mathematically. He then described the "method of least squares," which is used to determine the most likely mean value for any group of observations, in which the "weights" are inversely proportional to the squares of their probable errors.

Clark Chapman reviewed the 1960-61 opposition of Mars as observed by ALPO observers including himself. Mr. Chapman was given the ALPO Award later that evening at the banquet for the excellence and creativity of his work.

A featured speaker that day was Dr. Helen Sawyer Hogg of the David Dunlap Observatory, in Toronto. An authority on star clusters, Mrs. Hogg chose instead as her subject the work of Canadian optical and radio telescope observatories, illustrating her talk with slides and a number of very unscientific cartoons which served to prove that both Mrs. Hogg and her audience had senses of humor. Many of the listeners and viewers were not familiar with Canadian astronomy and were extremely impressed with the wide variety of projects pursued by its astronomers—especially in the fields of stellar spectroscopy, radio astronomy and meteor research. Especially interesting was Mrs. Hogg's coverage of the evolving discoveries of more and more meteor craters in the great unpopulated territories of Canada. All agreed that Dr. Hogg



League vice-president Ralph Dakin discussed details of the 24-inch Schmidt telescope at the University of Michigan's Portage Lake station with two League members. Adjusting camera at rear is Robert E. Cox.

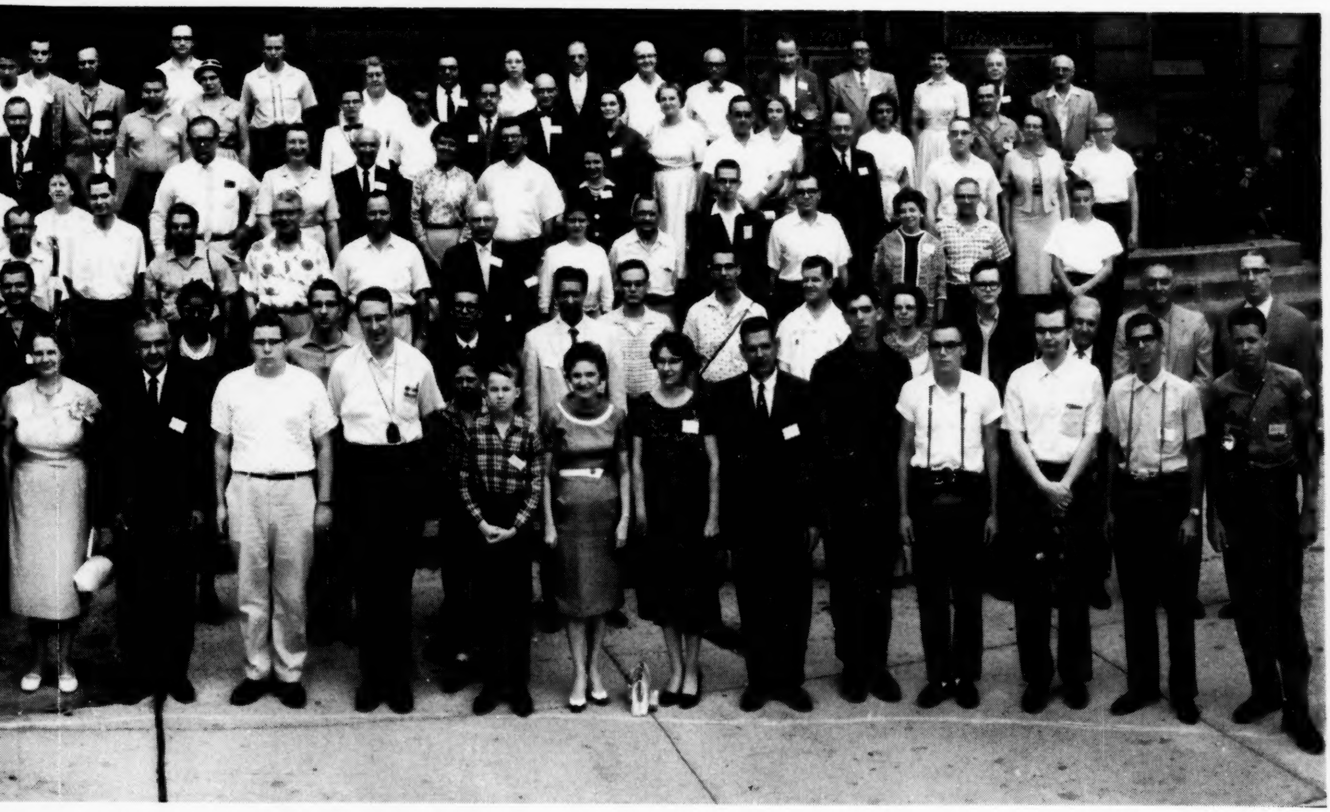
Members of the Astronomical League Convent for a group picture during break in the proceed in walk) is League treasurer Leonard Pardue. light-meter, is vice-president Ralph Dakin. To Helen S. Hogg, president Norman Dalke, ALPO retary Miss Wilma Cherup, and Richard Lloyd Detroit Astronomical Society.

was a most pleasant and charming addition to the convention.

Telescope-making authority Robert E. Cox, attending his first League convention in many years, made up for his delinquency by giving two papers during the Monday sessions, the first on a project of St. Louis amateurs to observe and measure the light of the elusive "gegenschein," the second on instruments for planetary work, in which he emphasized the importance of good eyepieces (field-tested before purchase, if possible) and smaller diagonals for less difraction effect.

League vice-president Ralph Dakin covered the little understood question of "Why a Telescope Does Not Magnify," a confounding title to some at first but readily understandable after Dakin had completed his talk. Miss Bernadette Loudak gave an informal and humorous talk on the problems of teaching science and astronomy to elementary-school children; one technique she used was to pay her little brother to listen to her lectures! Just before her discussion, an eight-year-old girl, Miss Diana DeWald, had showed some slides of lunar features and discussed them knowledgeably—without the aid of a little brother!

As convention chairman C. D. Marshall made his closing remarks to the group, delegates began to look at their watches and time-tables, and a last pound of the gavel brought the 15th annual meeting of the Astronomical League to an end. The location of the 1962 convention was still undecided at that time, although Albuquerque, N. M., Kansas City, Mo.. and Fayette, Mo., site of the Morrison Observatory of Central College, were all under consideration.



**gue Convention at Detroit, July 1-3, 1961, pose
n the proceedings. In front row (center, at crack
ard Pardue. Second to his left, with omnipresent
n Dakin. To Pardue's right are (in order): Dr.
Dalke, ALPO director Walter Haas, executive sec-
ichard Lloyd (with wife), president of the host**

CONVENTION SIDELIGHTS

The impact of several hundred amateur astronomers on the city of Detroit was slightly diluted by the presence of some 18,000 garishly garbed square dancers who were attending a national square dance festival. A bellhop in the Henrose Hotel was heard to remark: "I can tell them astronomers from the square dancers any time—the astronomers all wear glasses!" Indignant amateurs felt that there were equally discernable characteristics by which to identify a square dancer!

* * *

The short-sightedness on the part of the Portage Lake Observatory administrators in not laying out an access road which would accommodate Greyhound buses came in for crisp comment during the convention field trip. Attempts to negotiate a hairpin turn in the road after leaving the Schmidt dome resulted in a massive and total "hang up" for several of the buses. It was the opinion of observers that this delay would not have occurred had the sweltering drivers accepted the advice offered so freely, often and clearly by their passengers.

* * *

Walter H. Haas was feted by his ALPO colleagues at an informal luncheon on the occasion of his birthday (for which no quantitative data was made available by this usually reliable observer). Besides a cake, Mr. Haas was presented with several publications which were designed "to assist him in adding to the sum total of planetary knowledge." Guests at the luncheon still recall with glee the shocked look on his face when this new "literature" turned out to be several copies of current astrology and horoscope magazines!

Equally memorable was Mr. Haas's horoscope, which suggested to the long-time editor of the excellent publication, STROLLING ASTRONOMER, that "he had literary ambitions, but that he should seek the counsel of his colleagues to determine if these ambitions were well founded"!

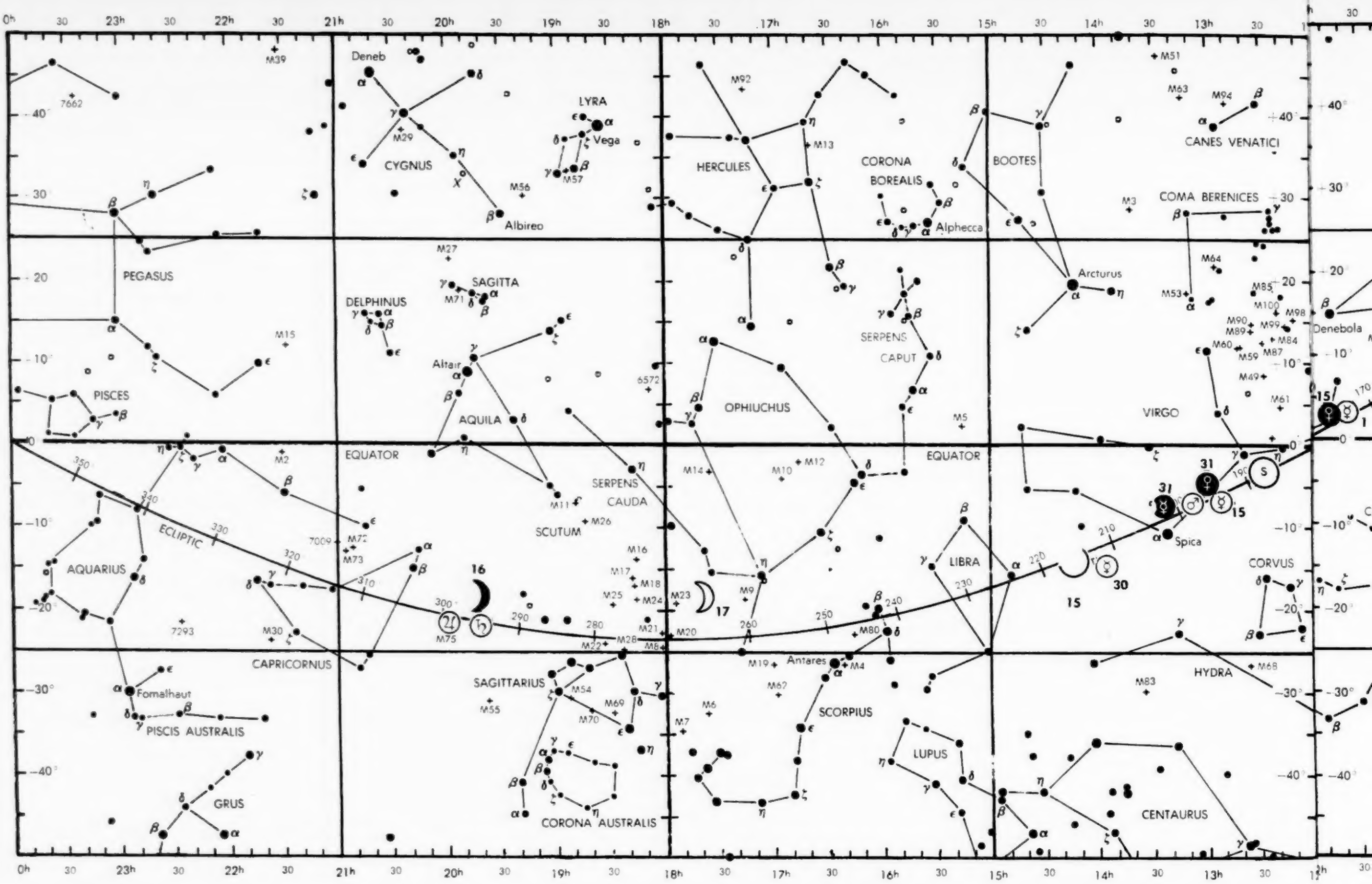
Assembled celebrants at the above luncheon also remember with equal clarity the look on the face of this writer when he discovered that one of the astrology magazines had copied the star charts used in the MONTHLY EVENING SKY MAP, predecessor to THE REVIEW OF POPULAR ASTRONOMY.

* * *

Many new commercial exhibitors were present at the convention, and amateurs who remembered the hobby in its leaner days could scarcely pass one of these without comment. This particular booth was manned by a market research specialist from Los Angeles, who had permission to make a survey of the present equipment and future needs of the assembled amateurs. The research organization represented a firm on the West Coast which is planning to expand into the field of astronomical equipment.

Such efforts, welcome though they are, are a far cry from the days when one of the main topics of conversation at astronomical gatherings was inside information about the source of mirrors, lenses, eyepieces, books, magazines and telescopes. Actually, most of the commercial sources of supplies and equipment that make up today's "telescope industry" have come into existence during the past decade. Before this, the average amateur had to "root for himself!" It's a wonderful world, and we love it.

D.D.Z.



EQUATORIAL SKY MAP

The charts on these pages show the star field from the equator to 50° south and 50° north. Right ascension is measured from west to east in hours; each notch at the top and bottom of the charts represents 10m of right ascension. Declination is measured to the north and south of the equator in degrees plus or minus; each notch at the right and left of the chart represents 5° of declination. Longitude along ecliptic is measured in 10° segments.

SEPTEMBER AND OCTOBER AMONG THE PLANETS

SUN: Beginning September in Leo, the sun will move into Virgo before the middle of the month. The autumnal equinox will be reached on September 23rd at 1:43 a.m. E.S.T. The declination of the sun will decrease from +8° 27′ to –13° 38′ during the two-month period as the days begin to diminish in length.

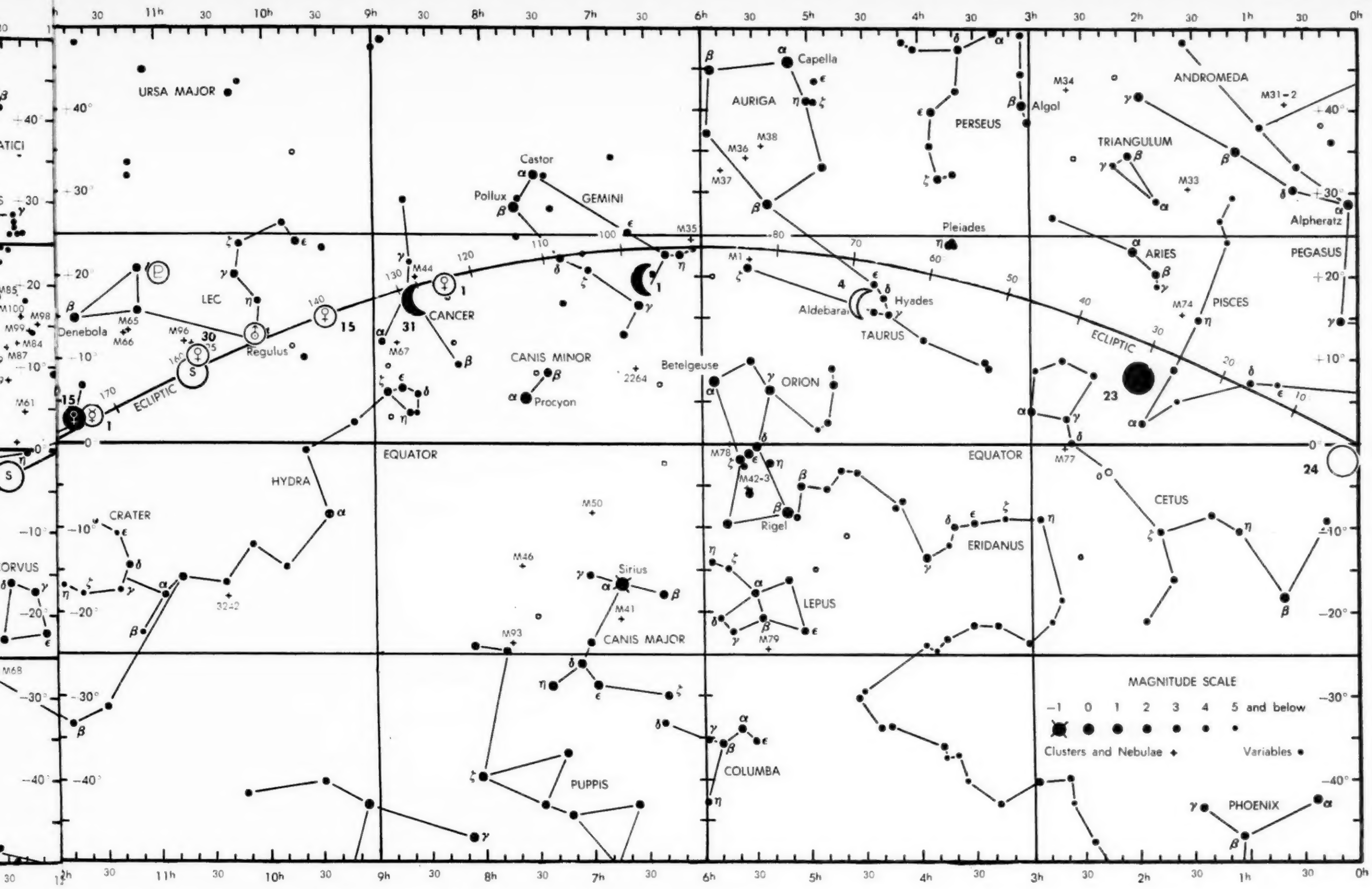
MERCURY: An evening star, Mercury will increase its elongation from the sun from 15° east on September 1st to 26° on September 28th at greatest elongation. For several days before and after this date Mercury may be observed low in the western sky as a star of +0.3 magnitude, but this apparition will not be very favorable. Inferior conjunction will occur on October 22nd when the planet will become a morning star, but too close to the sun for easy observation.

VENUS: The angular distance of Venus from the sun between September 1st and October 31st will decrease from 36° to 21°. Its stellar magnitude will be fairly constant at –3.4 as it approaches the far side of the sun. It will pass the descending node on September 5th, crossing to the south side of the ecliptic.

MARS: The sun will be approaching Mars slowly as their apparent angular separation decreases from 31° to 13° during September and October. Mars will be too close to the sun to observe.

JUPITER: The greatest of the planets will be retrograding as September begins, but will become stationary on September 23rd, from which date it will slowly begin its direct motion eastward. Its magnitude—changing from –2.3 to –1.9—will make Jupiter easily the brightest object other than the moon to be found in the evening sky. It will be in western Capricornus during the entire period. With an equatorial apparent diameter of 46″ to 38″ of arc, Jupiter will present a disc large enough for satisfying telescopic views in the smallest telescope.

SATURN: West of Jupiter near the Sagittarius-Capricornus boundary, Saturn will continue to be an unique and fascinating body. It becomes stationary on September 27th, after which date it will resume its motion eastward among the stars. At magnitude +0.6 to +0.8, Saturn is the brightest object (except Jupiter) in this part of the sky. The stationary phenomenon of planets is an interest-



Planets are indicated by standard symbols (see key). White circles for first month; black circles for second month. Moon plotted for exact time of phase (new moon omitted). Mercury and Venus are shown for first, middle and end of months; Mars for middle of month; other planets for mean positions during the two-month period. Sun is shown for first of each month.

KEY TO PLANET SYMBOLS

Mercury	☿	Saturn	♄	First Q. Moon	☽
Venus	♀	Uranus	♅	Full Moon	○
Mars	♂	Neptune	♆	Last Q. Moon	☾
Jupiter	♃	Pluto	P	Sun	S

ing one to examine on a plan of the orbits such as the heliocentric planet charts on page 26. Notice that a line joining Saturn (or Jupiter) on the stationary date is nearly tangent to the earth's orbit. At that time the earth's orbital motion will be directly away from the planet.

Uranus: Throughout September and October Uranus will remain in western Leo, near Regulus, in the morning sky. It will pass Regulus on October 11th, when it approaches to within 0°.3 of that star. Binoculars will enable one to see this sixth-magnitude planet with ease.

Neptune: This eighth-magnitude planet will continue to occupy the region of the Virgo-Libra boundary, but will be too close to the sun for observation during October, and too near the horizon after sunset in September. Conjunction with the sun will come a few days after the end of October.

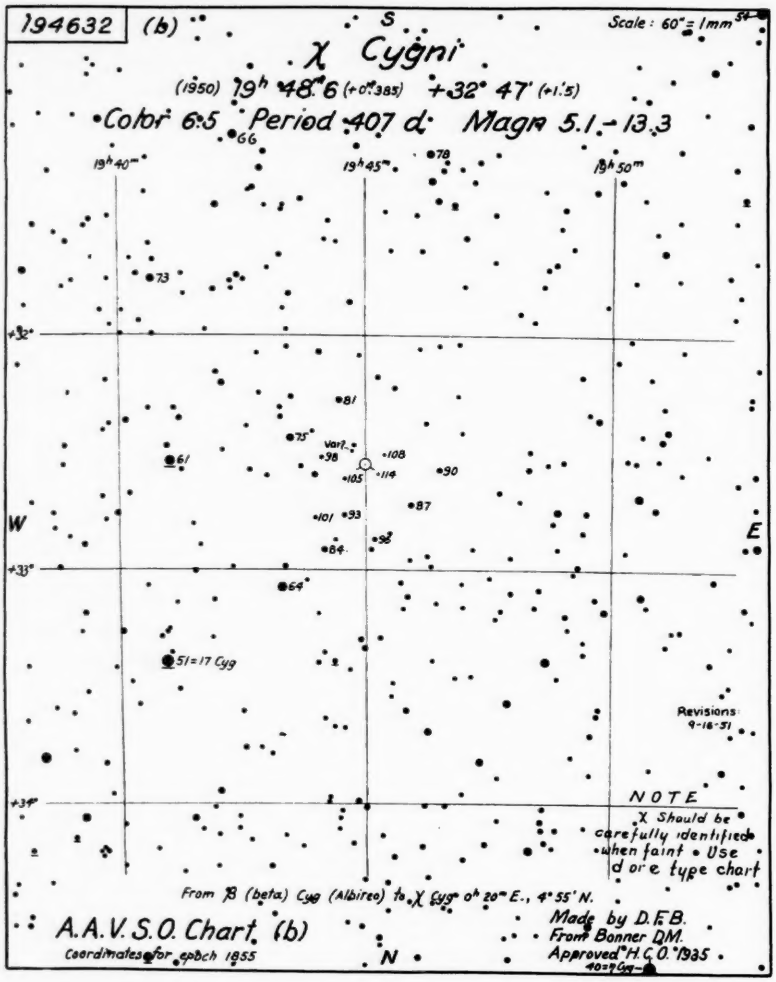
SKY WATCHER'S DIARY

SEPTEMBER

Date	Hour (EST)	Event
1	18	Last quarter
		Aldebaran 0°.3 S. of moon
6	19	Venus 2° N. of moon
7	15	Moon at apogee
8	06	Uranus 0°.7 N. of moon
8	10	Regulus 0°.3 N. of moon
9	12	Pallas at opposition
		New moon
11	17	Mercury 4° S. of moon
12	06	Mars 4° S. of moon
14	02	Neptune 3° S. of moon
17	09	Juno at opposition
19	17	Saturn 3° S. of moon
20	00	Jupiter 3° S. of moon
	06	Mars 2° N. of Spica
21	07	Mercury 0°.1 N. of Uranus
	22	Mercury 0°.1 N. of Uranus
22	16	Mercury 3° S. of Mars
	18	Venus 0°.4 N. of Regulus
	23	Moon at perigee
23	02	Equinox
24	07	Full moon
28	05	Mercury greatest elong. E. (26°).
29	02	Aldebaran 0°.4 S. of moon

OCTOBER

Date	Hour (EST)	Event
1	06	Vesta stationary
	09	Last quarter
5	03	Moon at apogee
	16	Uranus 0°.5 N. of moon
		Regulus 0°.2 N. of moon
7	03	Venus 0°.5 S. of moon
9	14	New moon
10	20	Mercury stationary
11	01	Mars 5° S. of moon
	02	Mercury 9° S. of moon
	10	Neptune 3° S. of moon
	15	Mercury 4° S. of Mars
	18	Uranus 0°.3 N. of Regulus
17	00	First quarter
		Saturn 3° S. of moon
	09	Jupiter 3° S. of moon
	17	Mars 1°.9 S. of Neptune
21	02	Moon at perigee
22	14	Mercury in inferior conj.
23	17	Full moon
26	12	Aldebaran 0°.6 S. of moon
31	03	Mercury stationary
31	04	Last quarter



AAVSO "b" chart of the variable Chi Cygni, which has one of the greatest magnitude variations (5.1-13.3) of all variables. Chi is at center of circle at center of chart; magnitudes are given without decimals to avoid confusion with stars. Key star to locate is 17 Cygni at 5.1. There are charts with fainter comparison stars for use when Chi is near minimum. (Courtesy AAVSO)

THROUGH THE THREE-INCH

OBSERVING VARIABLE STARS

WE WERE MOST HAPPY to receive the notes and drawing of off-trail celestial objects which appear elsewhere in this issue. It is quite true that the average telescopist becomes familiar with a few bright and easily accessible show objects and then begins to let his instrument gather dust. Now, telescopes were designed to gather light, not dust, but they also do the latter job quite effectively. It is our goal to "stamp out" attic- and basement-type telescopes, because these are the only proper places to store dust-gathering instruments.

Mr. John Mallas, the communicator of these random notes on interesting objects, suggests that the amateur hasn't access to the descriptive catalogs and lists of yesteryear, and this is possibly quite true. However, we would suggest further that perhaps today's amateur is pulled in to astronomy too fast for his own good, and that he should take the time to learn how to use his telescope, his charts and his head. While we too decry the absence of such works as Admiral Smyth's *Celestial Cycle* and The Reverend Webb's *Telescopic Objects for Common Telescopes*, both written with love, wit, personality and literary charm, we also know that lists of interesting objects are becoming more readily available as interest in astronomy grows. Rather, we feel that the average amateur just doesn't know how to go about finding these objects!

The moon, Jupiter, Saturn, the Andromeda galaxy, the Orion nebula, Albireo—finding these is little more than a matter of pointing. These are all naked-eye objects, and "must" items for the beginner, of course. But how to locate an asteroid? A faint planetary nebula? An elusive 6th magnitude double? This is another problem.

And—this is also a sneak in the back door with a cold and calculated "plug" for the art of variable star observing. "The Story of the AAVSO," which we are proud to publish for the first time in this magazine, tells only partly the story of the work of the American Association of Variable Star Observers. The second part of this article will tell more of the organization's activities and of its place in astronomy today, but we would like to dwell on variable star work from the point of view of an amateur learning to use his telescope.

We can think of no better way to learn one's way about the celestial sphere than to practice the variable star observer's art. Beyond the opportunity to make a contribution to professional astronomy — a chance not commonly available to the average amateur—variable star observing is a training ground for a satisfying lifetime of telescopic observation.

First, it requires the observer to locate objects fainter than 6th magnitude—and most objects in the sky are, you know. To do this, the telescopists must use special charts furnished by the AAVSO, and these charts cover a small area of the sky —in some cases, little more than the field of view of the telescope. It is usually the rule that these charts do not contain any conspicuous stars; the Great Plan of the Universe did

not extend to details of locating all objects of interest next to 1st-magnitude stars.

Thus, the observer without setting circles on his telescope must first locate the field of his variable star in relation to known stars and constellations nearby. When he finds the nearest identifiable star, he then works his way toward the variable in a most interesting fashion. With his set of charts for the variable beside him, he relates the field of stars about the identified star to what he sees in his glass. Invariably (perhaps an inappropriate word) the variable star observer will find a row of stars, a triangle, a little double, or some other asterism that will carry him nearer and nearer to his taget. The field of view and the charts must become one—and the eye and brain of the observer must be the catalyst.

In using the charts, the amateur also learns the scale of his instrument's field of view as compared to his charts—just how big that small triangle on the chart will appear to be in his telescope with, say, a 1" ocular (or vice versa). Such lore is a vital prerequisite to successful sky-hunting, but the writer is still amazed at the number of observers who are not familiar with these basic concepts and relationships. This has been dramatized in the experience of Moonwatch team leaders across the country with whom we have talked—"most of our errors or abortive sessions result from observers not being able to identify their fields on star charts." Likewise, they have a similar problem when asked to place a Moonwatch telescope on a specified field, using a good star chart.

Before applying this star-hopping to the telescope, an amateur can take a "dry run" using the naked-eye constellations. Start with the Big Dipper—follow the arc it makes until the eye encounters Arcturus. One length of Bootes' "kite" points northward to Theta Draconis, just one "kite" length away. And so on. After that, try it with a star chart and binoculars—then move on to a telescope.

Basically, this is the way a variable star observer locates his field—at least for the first time. As time goes on and the star is frequently worked, the observer finds he can point his instrument directly at the field. Although this writer has done little variable star observing during the past few years, there are still some two-dozen star fields so firmly fixed in his mind that he could draw a rough picture of them at a moment's notice.

A second advantage of variable star observing is that it trains the amateur to see stars as something more than points of light. The observer soon becomes sensitive to the brightness of stars in the field; he knows what to expect, for example, when a new chart lists a key star in the field at 5.9 magnitude—an extra aid in identifying a variable field. Star colors become more apparent—especially the orangish or red stars, which can give misleading brightness impressions if they are not recognized in advance.

This technique develops in part from the business of locating the field, but more so from the process of magnitude estimation. When the field is located, and the type of AAVSO chart to fit the approximate

(Continued on page 24)

(Continued from page 23)

brightness of the variable is selected, the observer selects several nearby stars of apparent brightness both above and below the variable. The comparison stars on these charts are designated by brightness to the nearest tenth of a magnitude, so by one of several methods available the observer uses these comparison stars to arrive at an accurate magnitude estimate for the variable at that particular time. Some variables have regular periods of 50 to 500 days, and seldom stray from their path, but other are semi-regular in nature, always ready to surprise an unwary telescopist. Still others are quite irregular, moving to maximum and minimum brightness at a moment's notice, or making a "stillstand" at a constant brightness for a long period before proceeding with their fluctuations.

An observer's eyes and brain soon become quite sensitive to small magnitude differences. The writer and Mr. Stuart O'Byrne, author of an article on star colors in the July-August issue—neither of us regular observers in recent years—once observed more than a dozen stars together using the same instrument and different estimation techniques. We found that our magnitude spread was actually less than one-tenth of a magnitude—less than the accuracy of the chart magnitudes. (It must be mentioned, however, that this is not really important if an observer is consistent, and can be allowed for.) Skilled observers carry their "steps," used in determining the extent of magnitude differences, to much smaller parts than one-tenth of a magnitude.

Finally, variable star observing teaches the observer something about himself and the curious physiological and psychological influences to which the human body and mind are subject. He learns, as mentioned previously, about colors, and how red stars "bore into the retina" if stared at and give an unduly bright impression of their brightness. He also learns that the head should be vertical when making a comparison, and further, that the line between the eyes should also parallel a line between the comparison star and the variable. This can create some challenging situations, it's true, but this is part of the fun and satisfaction of variable star observing. Also, an observer learns to avert his vision to

(Continued on page 27)

HOW TO USE THESE OCCULTATION PREDICTIONS

Predictions are made by H. M. Nautical Almanac Office for 12 stations in the United States and Canada. Some of these stations actually lie within certain large cities, but others are merely selected for geographical location and do not coincide with specific cities. Unless you live within a few miles of the points designated by longitude and latitude coordinates of one of these standard stations, correction must be made to the times given in the above list.

First, the longitude and latitude of the nearest standard station must be subtracted from your own longitude and latitude. If you are north of the standard-station latitude or north of the standard-station longitude, the sum will carry a minus sign. The difference in longitude is then multiplied by the longitude correction figure given in the tables for your standard station; likewise for the latitude correction. These two quantities are then added, being careful throughout to take into account the plus and minus signs. The sum of these two numbers will be your corrected factor for that occultation, and is subtracted or added, as the signs demand, from the listed time of occultation. These times are only a guide, however, and you should be prepared to begin observations a few minutes in advance of the predicted time.

Occulted stars are designated in most cases by constellation and appropriate Greek letter designation or Flamsteed number. In some cases the *Bonner Durchmusterung* catalog number (e.g. 57° 485) is used for fainter stars. Only stars brighter than 5.0 are published in this selected list. Complete predictions of all observable occultations are published in advance for each year in the December issue of SKY AND TELESCOPE magazine.

The column under "Phenomenon" shows whether the occultation is a disappearance (D), a reappearance (R), or a grazing occultation (G), which may or may not occur for a particular station. Age of the moon is given in days from new moon, and the position angle on the limb of the moon is given in degrees. Position angle is measured eastward from north; orientation can be determined by letting the moon drift through the field of view to establish the east-west axis. Be certain to allow for inversion by the telescope: in a normal situation, looking generally southward from the zenith, north (0°) will be toward the bottom of the field; south (180°) at the top; east (90°) at the right; and west (270°) at the left.

Observations should be sent, as soon after the end of the year as possible, to H. M. Nautical Almanac Office, Royal Greenwich Observatory, Herstmonceux Castle, Hailsham, Sussex, England.

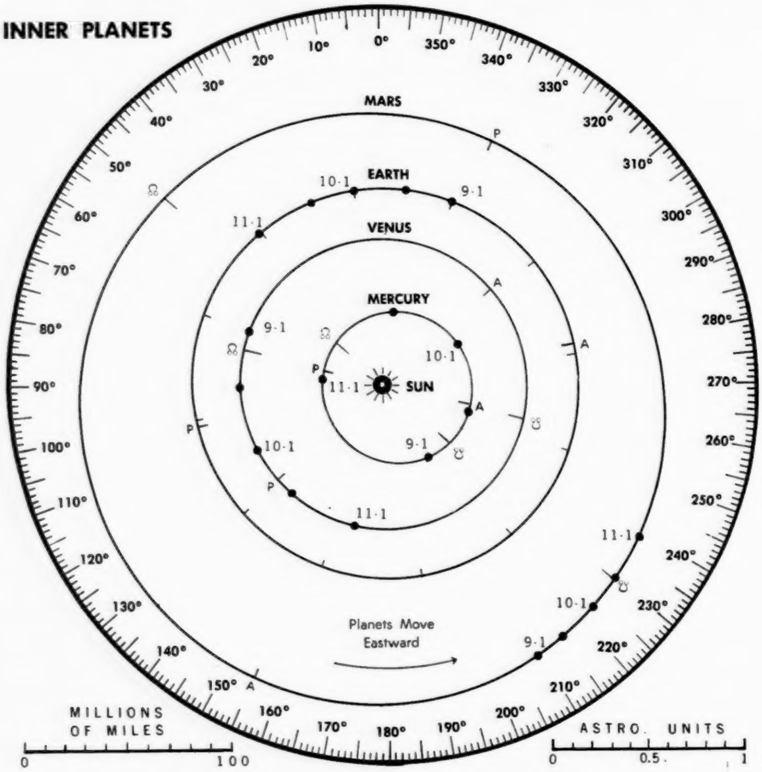
Station & Location	Long.	Lat.
A (Massachusetts)	72°.5	42°.5
B (Montreal)	73°.6	45°.5
C (Washington, D. C.)	77°.1	38°.9
D (Toronto)	79°.4	43°.7
F (Illinois)	91°.0	40°.0
G (Texas)	98°.0	31°.0
H (Denver)	105°.0	39°.7
I (New Mexico-Arizona)	109°.0	34°.0
J (Edmonton, Alta.)	113°.1	53°.5
K (California)	120°.0	36°.0
L (Oregon)	121°.0	32°.5
M (Vancouver, B. C.)	123°.1	49°.5

LUNAR OCCULTATION PREDICTIONS — Sept.-Oct. 1961

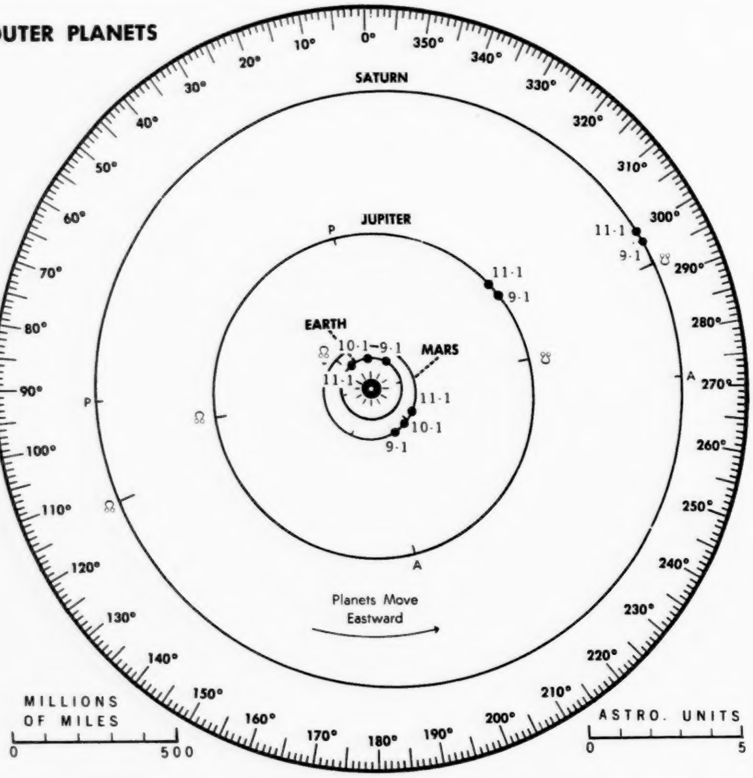
Sta.	Date	Name & Number	Mag.	Phen.	Age of Moon	(EST) Time	Correction Long.	Correction Lat.	Position Angle
A	Sept. 27	Mu Ceti 405	4.4	D	17	00:14.4	− 1.3	+ 1.6	62°
				R	17	01:30.8	− 1.7	+ 1.0	249°
	Sept. 28	Theta^1 Tauri 669	4.0	R	19	22:19.0	− 0.2	+ 1.3	270°
	Sept. 28	Theta^2 Tauri 671	3.6	R	19	22:19.5	0.0	+ 1.7	249°
	Sept. 28	264 B. Tauri 677	4.8	R	19	23:14.8	− 0.8	+ 0.7	292°
	Sept. 29	Alpha Tauri 692	1.1	D	19	01:10.1	− 0.9	+ 2.2	53°
				R	19	02:23.3	− 1.9	+ 0.6	273°
	Oct. 7	Sigma Leo 1644	4.1	R	27	05:15.7	− 0.5	− 0.6	323°
	Oct. 17	Rho Capricorni 2987	5.0	D	8	18:37.9	− 1.2	+ 2.1	22°
B	Sept. 27	Mu Ceti 405	4.4	D	17	00:18.2	− 1.1	+ 1.8	54°
				R	17	01:31.7	− 1.7	+ 0.8	258°
	Sept. 28	Theta^1 Tauri 669	4.0	R	19	22:22.7	− 0.2	+ 1.3	276°
	Sept. 28	Theta^2 Tauri 671	3.6	R	19	22:24.4	− 0.1	+ 1.6	255°
	Sept. 28	264 B. Tauri 677	4.8	R	19	23:15.8	− 0.9	+ 0.5	302°
	Sept. 29	Alpha Tauri 692	1.1	D	19	01:16.3	− 0.7	+ 2.5	43°
				R	19	02:22.5	− 1.9	+ 0.2	283°
	Oct. 7	Sigma Leo 1644	4.1	R	27	05:12.7	− 0.5	− 1.2	336°
	Oct. 17	Rho Capricorni 2987	5.0	D	8	18:44.0	......	......	9°
C	Sept. 27	Mu Ceti 405	4.4	D	17	00:02.7	− 1.2	+ 1.6	65°
				R	17	01:18.8	− 1.6	+ 1.3	245°
	Sept. 28	Theta^1 Tauri 699	4.0	R	19	22:13.9	0.0	+ 1.2	266°
	Sept. 28	Theta^2 Tauri 671	3.6	R	19	22:13.7	+ 0.1	+ 1.6	246°
	Sept. 28	264 B. Tauri 677	4.8	R	19	23:08.6	− 0.6	+ 0.8	288°
	Sept. 29	Alpha Tauri 692	1.1	D	19	00:58.4	− 0.8	+ 2.1	56°
				R	19	02:12.1	− 1.8	+ 0.9	268°
	Oct. 7	Sigma Leo 1644	4.1	R	27	05:14.6	− 0.4	− 0.1	309°
	Oct. 17	Rho Capricorni 2987	5.0	D	8	18:24.2	− 1.6	+ 2.1	28°
	Oct. 19	Sigma Aquarii 3307	4.9	D	10	21:55.7	......	......	353°
D	Sept. 27	Mu Ceti 405	4.4	D	17	00:08.8	− 0.9	+ 2.0	51°
				R	17	01:20.3	− 1.7	+ 0.9	260°
	Sept. 28	Theta^1 Tauri 699	4.0	R	19	22:19.4	− 0.1	+ 1.2	278°
	Sept. 28	Theta^2 Tauri 671	3.6	R	19	22:21.3	+ 0.1	+ 1.5	256°
	Sept. 28	264 B. Tauri 677	4.8	R	19	23:10.0	− 0.8	+ 0.4	304°
	Sept. 29	Alpha Tauri 692	1.1	D	19	01:07.7	− 0.5	+ 2.6	41°
				R	19	02:11.1	− 1.8	+ 0.4	284°
	Oct. 7	Sigma Leo 1644	4.1	R	27	05:12.0	− 0.4	− 0.8	329°
	Oct. 17	Rho Capricorni 2987	5.0	D	8	18:33.3	......	......	9°
F	Sept. 26	Mu Ceti 405	4.4	D	17	23:52.2	− 0.6	+ 2.1	46°
	Sept. 26	Mu Ceti 405	4.4	R	17	00:57.8	− 1.5	+ 1.1	266°
	Sept. 28	264 B. Tauri 677	4.8	R	19	23:02.2	− 0.4	+ 0.2	308°
	Sept. 29	Alpha Tauri 692	1.1	D	19	00:54.4	− 0.1	+ 2.6	36°
				R	19	01:49.9	− 1.5	+ 0.5	289°
G	Sept. 26	Mu Ceti 405	4.4	D	17	23:30.7	− 0.5	+ 1.7	59°
	Sept. 27	Mu Ceti 405	4.4	R	17	00:36.8	− 1.1	+ 1.4	253°
	Sept. 29	Alpha Tauri 692	1.1	D	19	00:33.2	0.0	+ 1.9	52°
				R	19	01:34.0	− 1.0	+ 1.0	272°
	Oct. 13	24 Scorpii 2399	5.0	D	4	20:48.2	− 0.5	+ 0.6	47°
H	Sept. 26	Mu Ceti 405	4.4	D	17	23:46.6	− 0.1	+ 2.4	32°
	Sept. 27	Mu Ceti 405	4.4	R	17	00:38.5	− 1.2	+ 0.9	283°
	Sept. 29	Alpha Tauri 692	1.1	D	19	00:56.1	+ 0.5	+ 3.2	17°
				R	19	01:30.5	− 1.3	− 0.2	310°
I	Sept. 26	Mu Ceti 405	4.4	D	17	23:33.5	− 0.1	+ 2.1	42°
	Sept. 27	Mu Ceti 405	4.4	R	17	00:29.0	− 0.9	+ 1.0	273°
	Sept. 29	Alpha Tauri 692	1.1	D	19	00:41.7	+ 0.4	+ 2.5	31°
				R	19	01:25.7	− 0.8	+ 0.3	296°
J	Oct. 26	Gamma Tauri 635	3.9	D	17	04:37.7	− 1.9	− 2.0	128°
				R	17	05:23.9	− 1.1	+ 2.6	203°
K	Sept. 27	Mu Ceti 405	4.4	R	17	00:22.0	− 0.6	+ 0.6	290°
	Sept. 29	Alpha Tauri 692	1.1	D	19	00:55.1	......	......	6°
				R	19	01:15.5	......	......	323°
L	Sept. 26	Mu Ceti 405	4.4						
	Sept. 27	Mu Ceti 405	4.4	D	17	23:56.6	+ 0.4	+ 3.2	7°
	Sept. 29	Alpha Tauri 692	1.1	R	17	00:23.6	− 0.9	− 0.1	311°
M	Oct. 26	Gamma Tauri 635	3.9	D	17	04:25.3	......	......	137°
				R	17	05:00.4	......	....	191°

Heliocentric Planet Charts for September and October

INNER PLANETS



OUTER PLANETS



Presented here are two new charts intended to show the heliocentric and geocentric movements and positions of the naked-eye planets. The upper indicates the orbits of the "terrestrial" planets—Mercury, Venus, earth and Mars—and the lower chart shows the orbits of Jupiter and Saturn, with those of Mars and earth for reference. The orbital positions of the inner planets are shown for the 1st and 15th of each month, from Sept. 1 to Nov. 1, 1961. The positions of Jupiter and Saturn are shown only for Sept. 1st and Nov. 1st, as their motions ahe relatively slow. Orbits are to scale.

Scales of distance in astronomical units (mean distance from earth to sun: 92,900,000 miles) and millions of miles are included for each chart, and can be used to measure approximate distances between any pair of planets, or planets and the sun. The nodes are indicated so that one may determine upon which side of the ecliptic, north or south, a planet will be found. Moving eastward, a planet, having crossed the ascending node (☊), will be *north* of the ecliptic, until it reaches the descending node (☋), when it crosses to the *south* until it passes the ascending node again. Positions of perihelion (P) and aphelion (A)—closest and farthest distance from the sun—are indicated by the appropriate letter and a long tick.

Progress of the planetary rhythms can be followed with considerable exactitude from month to month. Their configurations — conjunctions, oppositions, elongations, passages of perihelia, for example — should be easily noted. The interested reader will discover much other useful information that can be gleaned from study of this regular new feature.

Heliocentric and Geocentric Longitudes

The heliocentric longitude (i.e., as seen from *sun*) of a planet at any time can be read from the charts by drawing a straight line from the center of the sun through the planet and intersecting the outer scale of longitude at the required point. Dates between those indicated for any planet can be interpolated, or estimated.

An example of this simple and useful calculation can be found on page 24 of the March-April issue.

(Continued from page 24)
perceive faint stars "beyond" the limit of the instrument. So—it's not difficult to see that serious variable star observing is a demanding discipline. But it can be mastered quickly by a serious observer, and the techniques it teaches soon make the amateur's telescope "come alive" in his hands. With the proper charts, an experienced variable observer can spot an asteroid or Neptune against a sea of stars in a moment, or pluck a faint comet out of the blackness of the celestial curtain.

More than this, however, is the continuing excitement of each observation of these enigmatic stars which professional astronomers cannot possibly handle by themselves. AAVSO director Margaret Mayall will be happy to send the serious amateur information on becoming a variable star observer. Just send a letter stating your experience, background and equipment — plus $1.00 for the AAVSO Observing Manual. The address is AAVSO, 4 Brattle St., Cambridge 38, Mass.

We'll be spending more time on this interesting field of amateur observation in the future, but we thought the subject appropriate to bring to the attention of new amateurs at the time of the AAVSO's 50th anniversary. And also, variable star observing is the "field that made the three-inch famous." The minimum magnitudes of hundreds of AAVSO variables lie within the light-gathering limit of a good three-inch. As you'll soon find, it's an absorbing pastime—and you'll be in the company of some of the world's finest observers.

D.D.Z.

AMATEUR'S FORUM (Cont.)

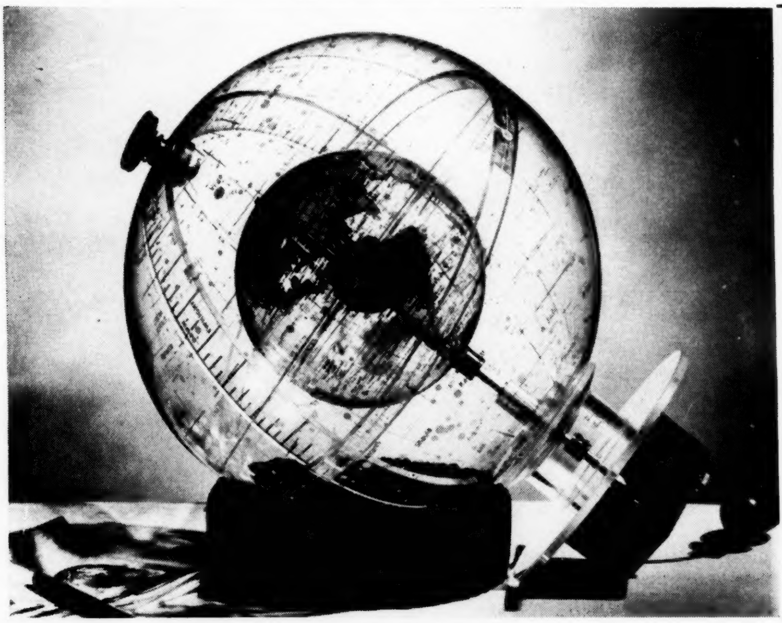
Dear Sirs:

I am an amateur astronomer of high school age. The phenomenon of Jupiter's Red Spot has always puzzled me and I have heard many different theories concerning it.

Could you please tell me if there is any one theory that is generally accepted by most astronomers.

Richard H. Wade
Laytonsville, Md.

The generally accepted theory today is that originally advanced by R. Wildt, which suggests in essence that the Red Spot is a cloud-like condensation at the top of a solid mass of material which is "floating" in equilibrium within an atmospheric "ocean" of liquified hydrogen. The Spot moves independently of the currents about it, having shown noticeable longitudinal drift over the past century. However, radio observations, when the signals become more discrete in their resolution, may give us further information on this enigmatic phenomenon. Incidentally, "our man" in Texas, Mr. J. Russell Smith of the Skyview Observatory, reports that the Red Spot was "quite prominent" in early August.



Author Mallas recommends this edge-wide galaxy, NGC 4565 in Coma, as an off-trail object for small instruments. Mallas, who lives in Covina, Calif., and uses a 4-inch refractor, decries emphasis on "show" objects.

Pencil sketches by author.

The Sky's "Forgotten" Objects - I

BY JOHN H. MALLAS

TODAY'S TELESCOPIC OBSERVER is prone to choose the well-known celestial show-pieces for his nightly fare, often overlooking nearby objects much more appropriate and satisfying to his own instrument and eye. Some of these off-trail objects are over-shadowed by prominent neighbors, while others remain unobserved because the attention of professional instruments has been given to the more photogenic targets —objects such as the Veil nebula and M33 in Triangulum, which are not available to modest instruments. This can be disheartening to the beginning amateur.

This is often true, and the observer is misled into thinking that perhaps there are not very many interesting objects for the amateur to view. He is often completely unaware of those overlooked objects in the sky that are indeed quite beautiful but for some reason or other have never achieved "stardom." Often these "lost objects" are far more interesting visually than their more fabled colleagues.

The amateur of a generation ago knew of these objects, for he had available some classic guides, most of which are no longer in print. Today's amateur must rely on occasional articles in journals, which are excellent but limited. Yet, today's amateur is far better off than 19th century observers in regard to equipment. Most modern amateur telescopes are superior in design to those of yesteryear, and there are also some fine atlases the amateur can purchase at a reasonable price. The combination makes it easy for him to locate objects to the limits of these atlases.

Submitted here are some of those "lost objects"—not actually lost, but "missing" from many modern observer's lists. The objects were chosen as being representative, and useful for both early and late evening observers. All of the objects are available to the writer's 4-inch refractor, and most are easy, even for smaller instruments. All the drawings were sketched during the observation and then refined immediately after the observing period. They show the detail an observer can expect, provided he takes the time really to "see" what he is looking at.

1. NGC 4565 11h 33m.9 +26°16′
Coma Berenices Galaxy

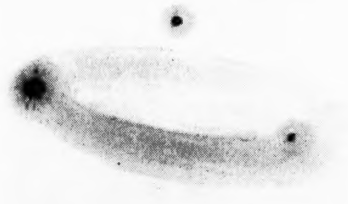
Located just off the "V" in Coma Berenices, this beauty will perplex even the experienced observer. On excellent nights, it has been seen in a 7x50 field glass, whereas even on good nights it has been a difficult object for a 4-inch. Because of its size (15′ x 1′), it is not an easy object for an f/15 refractor. Reflectors or refractors of shorter focal ratio (f/8 or less), will do much better.

In the 4-inch at 25x, the accompanying sketch illustrates its appearance. The dark lane is not easy to see, but with practice it will reveal itself. The nucleus is located just off center and is almost uniform in brightness, although the arms are not, being bright in patches. Catalogues give it a visual magnitude of 10.2. Walter Scott Houston calls it the "silver needle."

2. NGC 6905 20h 20m.2 +19°57′
Delphinus Planetary

"The Blue Flash," Its classification is III-a—oval, non-uniform in brightness. 44″ x 37″ in size and the magnitude of nebula and star are 11.9 and 14.2 respectively.

After turning a telescope on this object one will notice the small triangle of stars superimposed about it. Glimmering and flashing between the triangle is the little planetary. The careful observer will notice it in low powers, and a 4-inch f/15 at 120x reveals all that can be seen. At this power, it is indeed a surprise. Note the three stellar "halos" apparent in the drawing. They reveal the uneven brightness of the nebula. The lower portion is brighter to the left (in inverting telescope near meridian) and fades rapidly to the right. The upper portion is more difficult to see. The left side of the planetary is smooth and the right fades and then ends abruptly, showing a ragged appearance. There is more detail for a 4-inch in this planetary than in the Dumbbell nebula (M27). Its color ranges from blue to blue-gray. It seems much brighter than the 11.9 visual brightness assigned to it.



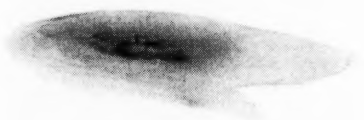
NGC 6905—an oval planetary nebula about the apparent size of the planet Saturn. A triangle of faint stars seems to be embedded within it.

3. NGC 205 0h 38m.6 +44°25′
Andromeda Galaxy

If the observer would search out this elliptical after viewing M31 and M32, he would complete his survey of the Andromeda system and be rewarded. It is an easy object and shows a surprising amount of detail. About 40x does well on it for it is not small (8′ x 3′) and of magnitude 9.4.

Visually, it looks completely dif-

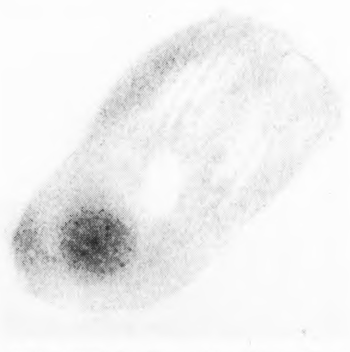
ferent from M32, which is also an elliptical. Oval-shaped with a brightening toward the center, it has a small extension on one side which can be seen by indirect viewing. Its appearance is nebulous rather than galactic, and its color is a soft gray without any of the granular texture visible which is often seen in galaxies.



NGC 205—one you've seen many times in photographs of its companion, M31 in Andromeda. Mallas suggests averted vision to detect slight irregularity in lower edge.

4. NGC 4826 12h 54m.3 +21°47′
Coma Berenices Galaxy

One of the Messier objects, it is often called the "Black-Eye nebula." It is stated that the dark central portion can only be seen by large instruments, but the author disagrees, for it can be seen by the experienced eye in a 4-inch glass on excellent nights. For sheer detail it is one of the best available galaxies for the 4-inch. Not only can the Black-eye nebula be seen but also some dark rifts to one side can be seen. Its general shape is oval, and it is unevenly bright. The brightest portion is the lower left, as shown in the sketch. Of dimensions of 8′ x 4′ and magnitude 8.8—the author suggests this object as a test for the experienced and patient observer. About 80x does best on it.



NGC 4826 in Dreyer's "New General Catalog," number 64 in Messier's shorter and more familiar list. Object offers great detail to small apertures, states author.

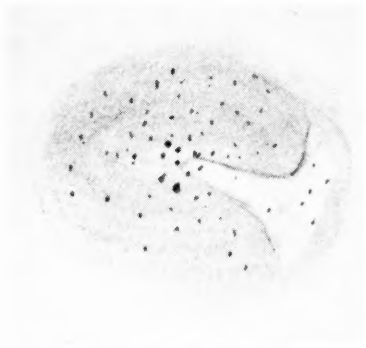
5. NGC 6818 19h 41m.1 –14°17′
Sagittarius Planetary

"The Little Gem." The bluest of the planetaries observed by the author. It is a beautiful nebula, visible in a 7x50 field glass as a blue star of magnitude 8 or 9. In low powers of the 4-inch, it gives the impression of a star out of focus. A power of 120x on a 4-inch reveals its true nature. Almost circular, very well defined on the edges, and uniform in brightness, it is indeed a vivid spectacle.

The careful observer will also notice the very small black hole in the center! It isn't easy at this magnification. Catalogues give it the following statistics: annular, dimensions of 22″ x 15″ of arc, magnitude of nebula and star are 9.9 and 15.0 respectively. This observer disagrees with the given nebula brightness; it seems brighter. One of the most beautiful blue hues to be seen.

6. NGC 6451 17h 47m.4 –30°11′
Scorpius Galactic cluster

The "Tom Thumb" cluster. A very interesting object. Dark areas within the cluster give the appearance of a thumb as shown in the drawing (in the drawing contrast is somewhat exaggerated). The stars are nearly all the same magnitude, with only a few bright members in the center. Use low powers. It is moderately rich, of integrated magnitude 8.3, contains an estimated 50 members, and is 6′ of arc in diameter.



Although contrast is slightly exaggerated in this drawing of NGC 6451 in Scorpius, it is interesting in lower powers and observable in binoculars.

7. I 4756 18h36m.6 +5°26′
Serpens Galactic cluster

Located on the edge of the Milky Way, it can be resolved into stars by a 7x50 field glass. It is quite large (70′). The author's jotted description after viewing it was: "beautiful, a myriad of stars, all colors; stars nearly all the same brightness, hundreds of patterns. Use lowest power available." The 4-inch gives the appearance of more than 80 stars, its estimated number. Other statistics are: magnitude of 5.1, loose and poor concentration.

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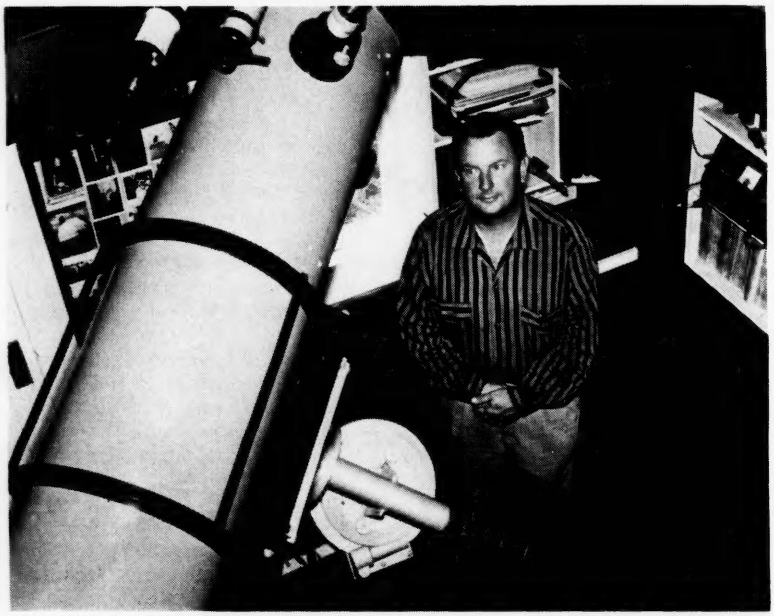
(Mr. Mallas, whose degree is in astronomy but who works in the computer field, is compiling a voluminous card file of his observations. His notes on "forgotten objects" will be continued in future issues.)



Editor's camera catches "star's-eye view" of author Cave in backyard observatory at his home in Long Beach during a recent visit to West Coast. Western amateur observatories, instruments and observers will be the subject of an article in the Nov.-Dec. issue of this magazine.

YOUR TELESCOPE AND MINE

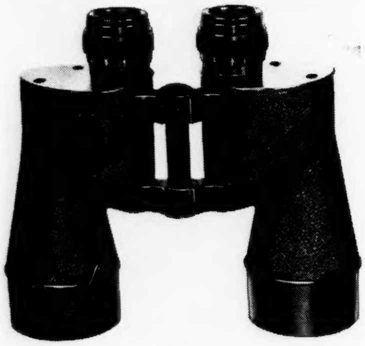
By Tom Cave

THE READERS WRITE . . .

WITH THE ADVENT once more of excellent late-summer and early-autumn observing weather and the heavens full of exciting deep-sky objects, we have begun to receive numerous questions regarding observing. For example, Mr. Vold Leinex of Kalamazoo, Mich., writes: "What range of binocular is powerful enough for finding most Messier objects down to the ninth magnitude?"

The modern prismatic binoculars most generally available are usually too small and not quite powerful enough to be really effective in searching out small nebulosities and compact globular star clusters. For years many amateurs have used the standard 7x50 binoculars, since they have a 7mm exit pupil (just right to fill a dark-adapted eye). These are often called the "Navy night glass." Although these are far better than most smaller-aperture and lower-power binoculars, they still do not have the magnification needed in deep sky searching.

In recent years the 20x60 prismatic binocular has become available at relatively little more cost than the 7x50's, and although its exit pupil is only 3mm the writer has found it far more effective than the smaller glasses. Even though the 20x60's have a much smaller field of view, the greater light grasp (70% greater) and higher magnification make them truly ideal for deep sky observing. During World War II Germany made a very heavy 10x80 binocular of high optical quality. Many of these were brought home



Although 7x50 binoculars such as these have long been recommended for astronomical use because of their optimum combination of aperture, and magnification, Cave recommends larger glasses for deep-sky searching. (Courtesy Edscorp)

by returning service men and have found their way into the hands of amateur astronomers. Perhaps no other binocular ever made has proven so effective for astronomical use as the 10x80.

A three-inch refractor may be converted into a richest-field telescope by adapting the tailpiece or rack-and-pinion focuser for a larger than normal draw-tube (2"-dia. is best) and incorporating a wide-angle war-surplus 1½" or 1¼" Erfle ocular giving about 30-35 power. With this arrangement a three-inch refractor of normal focal length will give roughly a 2½° field of view, and observing can truly be breathtaking on a dark, clear, moonless night in the richer parts of the Milky Way.

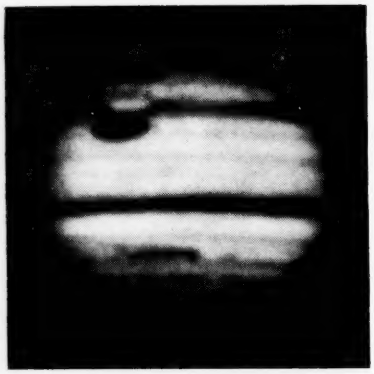
LIGHT-GATHERING POWER

A recent question from Jim Wimberley of Camp Wood, Texas, asks: "I would like to know which type of telescope (refractor or reflector) gathers the most light per inch of aperture?" Old books on telescopes and observing, such as Webb's *Celestial Objects for Common Telescopes*, give the achromatic refractor a decided advantage in light grasp over the reflector of equal aperture. One footnote from Webb's book states that "Arago [a French writer on astronomy] strangely asserted that no light was lost in achromatics, but the effects of absorption and reflection are so considerable that with very large apertures the advantage of the achromatic disappears. The silver-on-glass specula, invented by Foucault and Steinheil, but perfected in England, take their place between the metal Newtonian and the achromatic, approaching more nearly the latter."

The only improvement in many years in the light transmission of the refractor has been the coating of all air-glass surfaces with magnesium fluoride, which increases light transmission by a few per cent. With the development in the early 1930's of the high vacuum process of aluminizing, the reflecting telescope took a giant step in closing the gap between the effective light grasp of the reflector and refractor. As recently as 1923, Dr. W. H. Steavenson and Captain Maurice Ainsley, in their contributions to the out-of-print *Splendour of the Heavens*, stated that the refractor, inch for inch, brought more light to the observer's eye up to 9½ inches of aperture. Beyond 10 inches the reflector had greater light grasp—in fact, so much greater that a 30-inch reflector possesses about the same light grasp as a 40-inch refractor. The simple explanation for this is that, with every increase in aperture of an achromatic refractor lens, a proportionate increase must also be made in the thickness of the lens. The greater the thickness of the lens, the greater the light absorption by the glass and the greater the loss of light. Today, even with the addition of low-reflection coatings to lenses, reflectors of more than about 7½-inch aperture gather more light than an equal-size refractor. This explains why a small refractor usually gives brighter images than a small reflector.

FILTER FACTS

Most experienced planetary observers agree that the value of color filters can scarcely be exaggerated. Mr. Luis H. Martinez of Ponchatoula, La., writes: "I would like to know what filters I should use with my telescope for studying planetary details?" Even the very casual telescopic observer will find an orange or amber color filter of great aid when observing Mars. Often large areas of the maria and faint halftones in the desert regions of Mars are difficult to detect owing to low



Cave suggests light blue or green filter for bringing out belt details on Jupiter. Photo by 200-inch, courtesy Mount Wilson-Palomar Observatories.

contrast. Usually a yellow, orange or amber color filter will greatly enhance low Martian contrast details.

Besides increasing contrast, filters are often used by experienced observers to identify certain faint tones of color on Jupiter and Saturn. Usually for Jupiter a green or light blue filter will increase the contrast of the dark belt details, and a blue filter will enhance the small white markings in the belt structure of Jupiter.

When viewing Venus, particularly against a dark sky when the image of the planet is extremely bright, a neutral density filter will often bring out small irregularities in the terminator of the planet.

HIGH-ALTITUDE OBSERVING

Mr. J. H. Henley of Colorado Springs, Colo., writes to say: "Where I live seeing conditions are usually not good for high-power magnification in the study of the planets and the moon's surface. However, we have a remarkably clear sky at high elevations, and I plan to start some regular observing programs. What can you suggest?"

Where seeing conditions are not steady, but atmospheric transparency is extremely good—particularly away from city lights and at high altitudes—two fields of amateur research work may be effectively undertaken. One field is variable-star observing, which does not require the same quality of seeing as planetary or lunar observing.

The other field of observing, which is intensely interesting to those situated in a clear, high elevation, is comet seeking. Until fairly recently, a large percentage of new comets recorded each decade were discovered by amateur astronomers. Although today many comets are discovered coincidentally on photographic plates by cameras engaged in other work, comets are still constantly being discovered by amateurs who make a regular practice of sweeping the evening sky just after dark and the morning sky just before sunrise.

This can be best accomplished by using a 6- or 8-inch reflecting telescope of comparatively short focus. An 8-inch f/4 or f/5 reflector with a large, oversized diagonal and mounted on a simple alt-azimuth mounting that can be moved easily through large areas of the sky is perhaps the very best instrument to use.

A wide-field Erfle eyepiece, taking in 2° or 3° and giving a magnification of about 30 times, is most desirable for comet seeking. Refractors of similar aperture and focal length are classic in this field, but the requirements make them expensive if the optics are good.

If this field of observing were taken up by more amateurs equipped with the proper type of instrument, the number of comets found by amateurs would rapidly increase to at least the same annual total as discovered 20 or 30 years ago by active amateur astronmers. An average of about 200 observing hours has been found by many observers to bring the reward of at least one newly discovered comet.

(Editor's note: An unfortunate transposition of several lines in the last paragraphs of Tom Cave's article last issue has caused considerable reader queries. Remainder of second-last paragraph should read: " . . . the writer's personal 1½-inch Newtonian, on nights of excellent seeing, will give definition and resolution equal to the best 12-inch refractor. The greater ease of figuring the long-focus mirror and the larger tolerance for error in correction make this mirror well suited for the amateur mirror maker.")

ATM PLACEMENT BUREAU

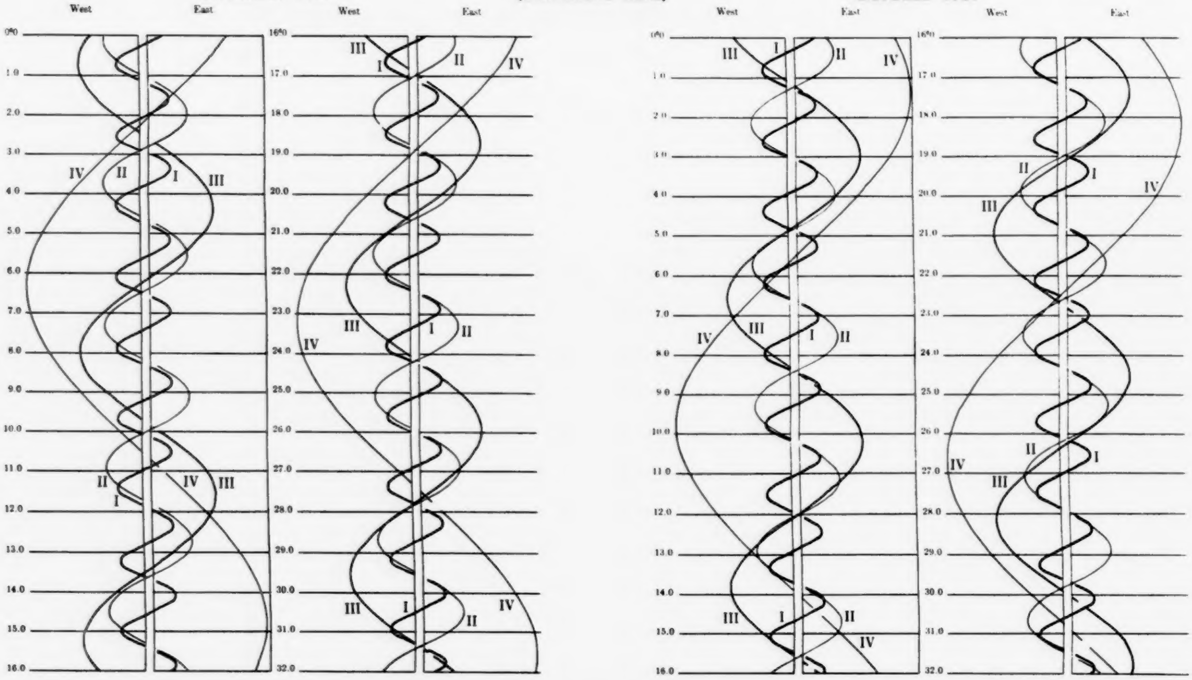
AMATEUR TELESCOPE MAKERS who might wish to make their hobby also their vocation may have the opportunity after registering their abilities and background with the newly formed Astronomical League Committee for Optical Placement. The committee includes well-known telescope makers Ralph K. Dakin, H. F. DaBoll and Robert E. Cox.

The purpose of this service will be to accumulate a list of experienced optical workers from the ranks of the amateur telescope makers and to make this list available to those in industry who might be interested in training such persons to become skilled optical technicians in the production and testing of high-quality optics. Optical firms throughout the United States have found the amateur telescope maker the best source of material for training of this sort, and the Astronomical League hopes that it can assist its members and interested amateurs throughout the country to locate suitable outles for their talents.

Now in preparation is material giving a suggested program of optical study and working techniques to prepare oneself for a professional career in optics. This brochure will be included with all requests for applications to register. There is no charge for this service, which is it expected will be in operation by the fall; likewise there is expected to be no expenses in its operation other than the time donated by committee members. Therefore, to obtain an application form and a suggested program of optical study, a stamped self-addressed envelope is necessary with all inquiries. Correspondence must also include a similar envelope if a reply is to be expected. No acknowledgment of a request for application will be sent without return postage. Inquiries should be addressed to Robert E. Cox, Chairman, Optical Placement Committee, 327 S. Main Street, O'Fallon, Missouri.

CONFIGURATIONS OF JUPITER'S SATELLITES (I-IV)

SEPTEMBER 1961 (UNIVERSAL TIME) OCTOBER 1961



Observable Phenomena of Jupiter's Satellites

SEPTEMBER

Date	Time (EST)	Satellite	Phen.
1	20:13	I	SI
	21:38	I	Te
	22:31	I	Se
	22:41	IV	TI
2	19:47	I	ER
5	21:59	III	TI
7	21:24	II	OD
	23:57	I	OD
8	21:09	I	TI
	22:09	I	SI
	23:26	I	Te
9	0:26	I	Se
	19:27	III	ER
	21:02	II	Se
	21:42	I	ER
10	21:29	IV	ER
14	23:50	II	OD
15	22:58	I	TI
16	0:04	I	SI
	19:50	III	ED
	20:13	I	OD
	20:47	II	SI
	21:26	II	Te
	23:28	III	ER
	23:37	I	ER
	23:37	II	Se
17	19:43	I	Te
	20:51	I	Se
23	19:01	III	OD
	21:02	II	TI
	22:03	I	OD
	22:37	III	OR
	23:22	II	SI
24	19:17	I	TI
	20:29	I	SI
	21:34	I	Te
	22:46	I	Se
25	20:01	I	ER
	20:57	II	ER
30	22:47	III	OD

OCTOBER

Date	Time (EST)	Satellite	Phen.
1	21:09	I	TI
	22:25	I	SI
2	21:56	I	ER
3	19:11	I	Se
4	21:29	III	Se
5	19:29	IV	SI
9	20:16	I	OD
	20:38	II	OD
10	18:49	I	SI
	19:48	I	Te
	21:06	I	Se
11	20:11	III	Te
	20:41	II	Se
	21:54	III	SI
13	21:24	IV	OR
17	19:26	I	TI
	20:45	I	SI
	21:43	I	Te
18	20:15	I	ER
	20:26	II	SI
	20:36	III	TI
	20:40	II	Te
20	18:12	II	ER
22	18:24	IV	Se
	19:34	III	ER
24	21:22	I	TI
25	18:34	I	OD
	20:27	II	TI
26	18:08	I	Te
	19:27	I	Se
27	20:50	II	ER
29	18:13	III	OR
	19:56	III	ED

(Times EST) E—eclipse (satellite passes into shadow of planet); O—occultation (satellite passes behind planet; T—transit (satellite or satellite shadow passes across disk of planet); S—shadow (shadow of satellite cast on disk by sun); D—disappearance; R—reappearance; I—ingress (entrance upon disk); e—egress (exit from disk). Satellite designations; I—Io; II—Europa; III—Ganymede; IV—Callisto.

EXPLANATION OF SATELLITE DIAGRAM

Effective with the unification of the British and American Nautical Almanacs the monthly configurations of Jupiter's bright satellites are now presented in a new and more useful type of diagram.

The central vertical band in the diagram represents the equatorial diameter of the disk of Jupiter. The relative positions of the satellites at any time with respect to the disk of Jupiter are given by the curves. In cases where a satellite is immersed in the shadow of Jupiter or occulted by its disk, the curve is interrupted.

The horizontal lines show the positions of the satellites at Oh Universal Time (Greenwich Mean Time) for each day of the month. For example, the horizontal line for the 15th of this month would show the positions of the satellites at 7:00 p.m. on the 14th of the month for an observer in the Eastern time zone.

(Diagrams taken from 1961 *American Ephemeris and Nautical Almanac.*)